OCTOBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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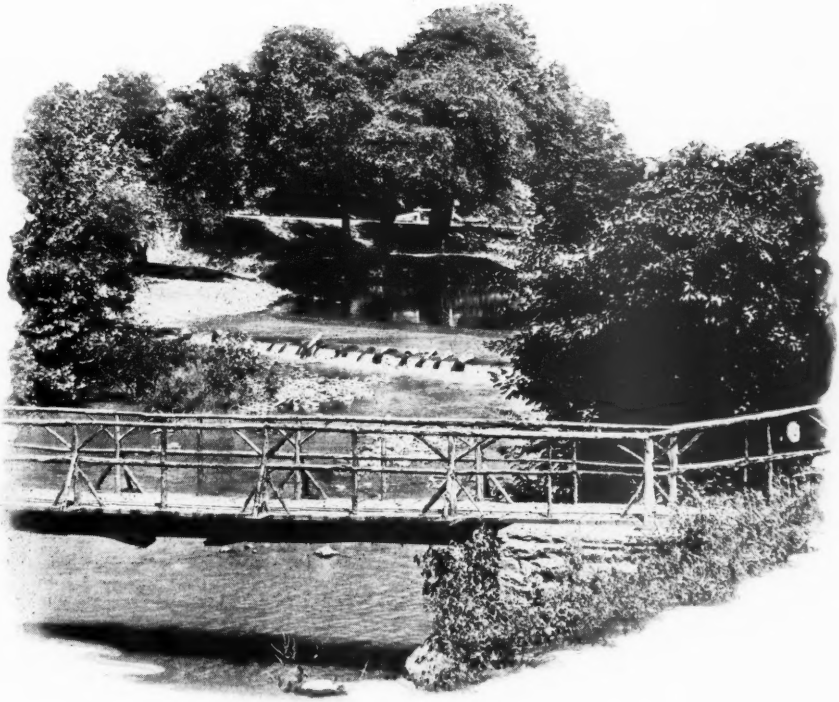

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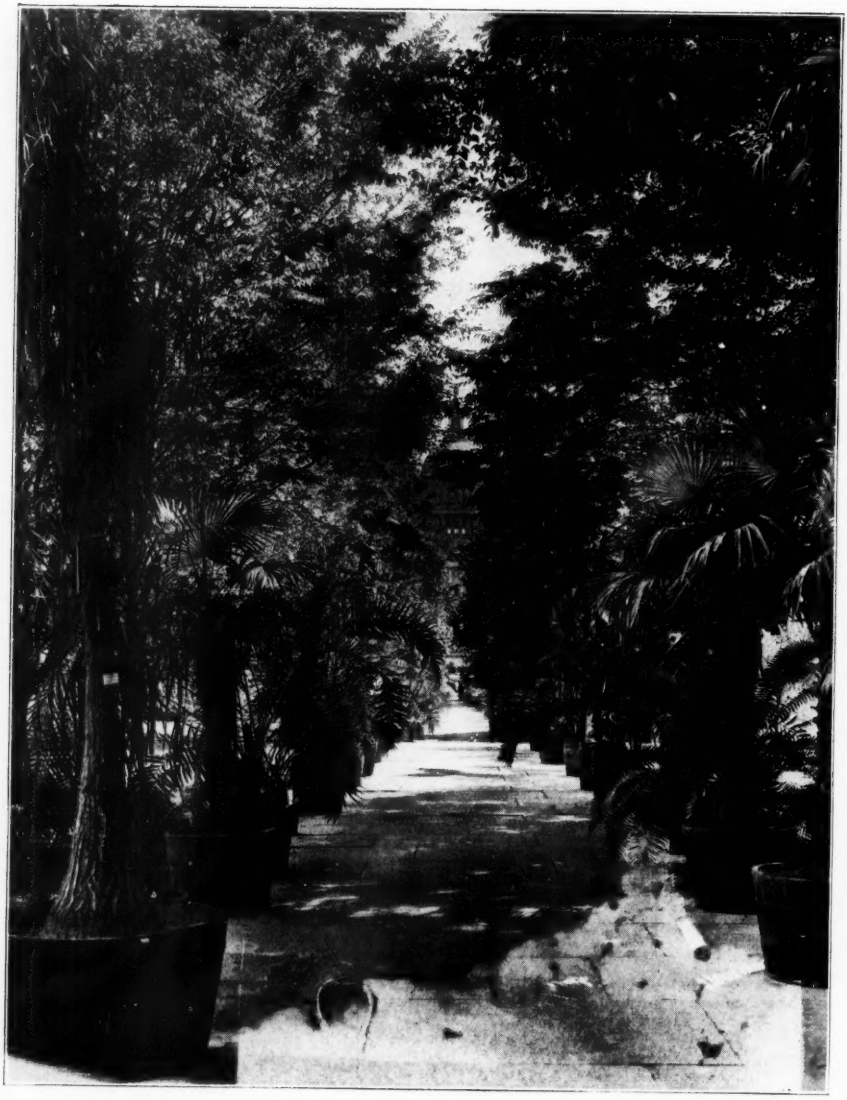

CAPITOL AT WASHINGTON, THROUGH THE BOTANICAL GARDENS

UNIV. OF MICH.

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 16 OCTOBER, 1929 No. 10

Original Communications

THE ONE-FOUR PLAN*

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Ga.

THE status of dental education is unstable and uncertain. There is, however, a very obvious reason for such a condition. In the first place, dentistry itself is rapidly undergoing an evolution from both its social and its professional standpoints. The profession may be compared to a growing boy: the clothes may fit well enough now, but they may be a sad incongruity six months or a year from now. In the second place, the period of time since the inauguration of the three most favored plans of dental education has not been long enough to be productive of statistical data sufficient to clinch an argument in one direction or the other. In other words, "not being hampered by facts, we may argue at length"—which I shall now proceed to do.

There is one thing upon which the advocates of the various plans of dental education are agreed; namely, that the time has come when candidates for the dental degree shall possess a broader preliminary education than formerly. With this primary conception in mind, as many as seven distinct plans have been evolved within the last few years, all of which have some ardent advocates. It would be difficult to say with accuracy just which of the plans is favored most, but I believe I am right in thinking that the one most popular with the masses is the one-four plan, which requires a full high school course, plus one year of college predental work, embracing such subjects as English, chemistry, biology, zoology and physics, totaling thirty semester hours, or not less than six semester hours in each subject, followed by a four-year course in dentistry, each year to consist of eight months. This plan is in accordance with the present standard set by

*Read at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 25, 1929.

*The papers of Drs. Byrnes, Ward and Rice, were presented as a symposium on "What Does the Progress to Date Reveal in Relative Values of the One-Four, the Two-Three and the Two-Four Plans in Dental Education?"

the Dental Educational Council of America, for all Class A institutions. It was officially adopted by the Council to take effect in 1926, and is now the minimum requirement in all Class A dental colleges. "Such popularity must be deserved," and there must be a very good underlying reason for this preference, some of which we shall attempt to uncover.

There are numerous phases which must be considered in the program of dental education. Some of these are not ripe for solution at the present time, and no doubt posterity will eventually dispose of them. There are certain fundamentals which must be dealt with in any educational program at any time. In the particular instance of dental education, I believe these fundamental questions to be, at the present time:

1. Is the present preliminary education as outlined under the one-four plan (one year of college work, which I have already described) sufficient to give the student of dentistry a thorough scientific and cultural background?

2. Is a course of four full years correct for the teaching of the biologic and technical phases of dentistry, or can it be lessened?

3. Will the economic condition of society warrant a further increase of the dental educational period? (This is probably the most important aspect of the whole subject, and I shall dwell on it somewhat at length in this paper later on.)

My answer to the first question is in the affirmative. I do not mean to infer that a year of college work will endow one with all the scholastic and cultural graces. Neither will two, three, four or a dozen years accomplish this if the man undergoing such training has not the scholarly and cultural type of mind. The mere memorizing of facts does not constitute education. Scholarship is a habit of mind, and no amount of mental stuffing alone can make a scholar of a man. Yet it is true that even the most gifted are handicapped in acquiring scholarship unless they have a foundation upon which to build. One year of predental college work will furnish such a foundation, and I believe it is adequate, when one considers the predental preparatory work in the light of economic conditions. While it is true that two years of predental college work and four years of dental training is that much better when considered *per se,* when considered from the standpoint of economics and sociology it becomes burdensome.

In answer to the second question (Is a course of four full years correct for the teaching of the biologic and technical phases of dentistry, or, can it be lessened?), it is my opinion, based upon years of personal observation in teaching, that it is utterly impossible to teach dentistry properly in less than four years of eight months each. The practice of dentistry has become so highly specialized and technical that even four years is hardly enough to cover more than the fundamentals. Under the one-four plan, the teaching of strictly dental subjects is accorded four-fifths, or 80 per cent, of the total time. By the same token, the two-three plan, which offers both the B.S. and D.D.S. degrees, might be said to allot approximately 60 per cent to strictly dental training. Is it not logical that the teaching of dentistry proper is four times as important as the immediate preparatory training, rather than three times as important?

The effort to popularize the combining of academic and professional degrees tends to discount the value of each. It

would seem to offer education in package form.

It is my opinion, however, that the one-four plan, while essentially sound, should be modified to eliminate one year's time, at the same time maintaining the full number of semester hours. As stated in an article published in 1925,[1] and as later brought out in my paper entitled, "Dental Education in the United States,"[2] read before the Sixth Australian Dental Congress, at Melbourne, August, 1927, pamphlet copies of which were reprinted by the congress, by authority of the government printer, this may be effected by requiring the standard one year of predental work, and by making each dental school year consist of four quarters of twelve weeks each, or forty-eight weeks in each session. The chief reason for my approval of this modification of the one-four plan is that such a plan would relieve an economic situation which is detrimental to the student as well as to the college. It is presumed that prospective students of dentistry, while ever alert to the profundity of their chosen mission in life, are nevertheless at least vaguely aware of the fact that they must make a living out of dentistry. Why, then, should they be compelled to spend but thirty-six out of fifty-two weeks in each year in the pursuit of learning? Why not four quarters of twelve weeks each, or forty-eight weeks in each session? This would make it possible to concentrate and accomplish in three sessions of forty-eight weeks each the equivalent of the present four sessions of thirty-six weeks each. Also, it would permit a minimum of two vacations of one month each, instead of three vacations of four months each, as is customary at the present time. The dental course would then consume three calendar years instead of four. There would be various other benefits to be derived from such a plan. It would make possible the employment of more and superior all-time instructors, and would thus indirectly better the discipline and raise the morale of both students and teachers. For those who would recoup their finances by vacations longer than one month, the introduction of quarters would permit them to take out either three months or four months, as they might choose, summer or winter, for such vacations.

The lessening of the time required for the completion of a dental course without the lessening of teaching, would, in the end, benefit the public, by reason of the fact that just in proportion to the cost of obtaining a dental education will the cost of dental service to the public increase. I must beg your indulgence for having spent so much time in the discussion of this modification of the one-four plan, which I first proposed at the second annual meeting of the American Association of Dental Schools, at Chicago, in March, 1925.[3]

Regardless of the method of distributing the time of study in a four-year course, I believe that such a course, coupled with the one year of predental work in an approved college or university, is sufficient to provide the student of dentistry with a thorough scientific, cultural and technical background, certainly in view of the present relationship of dentistry to the public at large.

The third question in connection with this problem (Will the economic condition of society warrant a further in-

1. Byrnes, R. R.: Dental Education, Dent. Cosmos, 67:395-398 (April) 1925.

2. Byrnes, R. R.: J. A. D. A., 16:1199 (July) 1929.

3. Proc. Second Annual Meeting American Association of Dental Schools, pp. 120-121.

crease of the dental educational period?) is probably one of the most important phases of the subject, and possibly the most overlooked. In our zeal for the improvement of the status of dentistry, we are liable to overlook one of the most vital considerations: that of furnishing dental service to the rank and file, and at a cost which is not prohibitive. The fees for dental service, of course, will be prohibitive to the masses, if dental students are compelled to wreck themselves financially and mortgage their income for a number of years in obtaining their education. We must remember that dentistry is for the public—not the public for dentistry. May we not, in our professional education, be drifting toward the abyss into which the Russian intellectuals were toppled by the envious, if less educated, masses who rebelled at the burden they were called on to bear by a not totally unlike condition? May we not be headed for a socialistic paternalism, forced on our government, if educational fanaticism does not make way for reason?

The addition of even one year to the period of training as called for in the two-four plan entails a financial sacrifice that will thwart numbers of competent students in their efforts to obtain a dental education. When we consider that the actual cost of an additional year of training, including supplies, tuition, etc., will amount to practically $2,000—to say nothing of the financial loss incurred in the employment of a year in study which otherwise could be employed in some gainful occupation—there can be no doubt as to the economic seriousness of adding another year to the dental curriculum. While I am fully aware of the value of higher and more extended education, it is, nevertheless, my humble opinion that these wantonly extended courses can claim neither soundness of economics nor efficiency of operation as an excuse for their adoption. As a matter of fact, if we exclude the economic feature of the problem from consideration, a period of training involving nine or ten years would be worth while (for no man can hope to learn all of dentistry even in a lifetime), but there are other and more important phases of the question to be considered than simply the personal problem of the dentist himself. There is an inexorable law that demand must be met with supply, and this economic balance between the dentist and the public cannot be maintained to the satisfaction of either if dental courses are to be extended wantonly and with disregard of all the factors involved in the problem.

SUMMARY

From the standpoint of the dentist himself, from the standpoint of the public and for the good of dentistry as a profession, the one-four plan is adequate, at least at the present time. The last few years has shown it to be an efficient working plan. There are two extremes to every question, and, in our zeal, we should avoid the error of either. The one-four plan occupies a sane, conservative middle ground in the problem of dental education.

106 Forrest Avenue.

THE TWO-THREE PLAN*

By M. L. WARD, Ann Arbor, Mich.

THE title of this symposium was communicated to me by the secretary of this association without anything to guide me regarding its origin. Whether it is one of those synthetic affairs to lure some of us to participate in the program of this meeting, or whether the subject is an organic one resulting from the activities of the officers of the association this year, has not been determined. When I read the proposed title as it appeared in a letter from the secretary of the association, the first thing that attracted my attention was the word "progress." As the title was studied a little more the words "relative values of the three curriculums" seemed to be outstanding in significance if there were to be three of us, each attempting to defend the soundness of the one of these curriculums in which he is most interested. There was, of course, an immediate association of the word "progress" and the words "relative values," with the words "dental education."

In view of the fact that we find ourselves involved in a transition in which there are at least three curriculums in use, the title suggested seemed so nearly ideal that a letter was sent to the secretary to inquire whether this title would appear in the program exactly as it was proposed. On receipt of assurance that the title would remain as proposed, it has been quite easy for me to rearrange the wording so that it meant "progress and relative values in dental education." This is what I wish it were, so the rearrangement has not been at all difficult. Henry Suzzalo, in his book, entitled "Our Faith in Education," says, "Men readily believe in the doctrines and theories which give them what they wish." This is certainly true with me as far as this title is concerned, for there has not been a time during my twenty-six years' experience as a dental teacher that the terms "progress" and "relative values" were more in need of clarification than at the present time.

Well do I remember what we said, and thought, in 1916, when all the dental colleges of this country agreed on a four years' curriculum, and how some of us planned to discontinue the granting of the D.D.Sc. degree and to substitute the M.S. degree upon the basis of our having met the *time* requirements of graduate schools. We had, as we thought, made such progress by the adoption of the four years curriculum that we were now upon a university basis. The assumption that we were upon a *true* university basis proved to be much like Lowell's statement that, "Truth is said to lie at the bottom of a well for the very reason, perhaps, that whoever looks down in search of her sees only his own image at the bottom." All we saw, for a long time after we made requests for admission to the graduate school, were our

*Read at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 25, 1929.

own deficiencies in the form of an image at the bottom of a deep well.

Those who have had some experience in getting the support of educators, the profession and the public toward the lengthening of a curriculum would probably say that when we received general approval of the movement to require four years for the degree of D.D.S., we had made progress. The time to be devoted to professional study proved to be only a part of the machinery through which we could later qualify for admission to the graduate school. We had yet to put our house in order. The same quality of students were coming to us and the same teachers were in charge of the lengthened curriculum, and when we began a sincere effort to change both of these conditions, we encountered much greater difficulties than we did in convincing those concerned that the time requirement for our degree was too short. In 1921, when we began to enforce a requirement of one year of literary work for admission after graduation from high school, we thought that our relations with the graduate school and the remainder of the university would be strengthened by the addition of the year of literary work to our professional requirements and that many of our troubles would now be over.

There were many precedents for this belief. Medicine had done it; Law had done it; Business Administration had done it; Education had done it, and similarly others had done it. Whether others suspected it or not, we do not know, but we were obliged to learn by experience that the literary colleges which were sending us our students had some troubles of their own, and as a result we were not getting such a high percentage of natively bright students as when we were admitting on a high school basis. It was, indeed, a great shock to us to review the reports on freshman students at the end of the first semester, when we found for the first time that the literary colleges doing preprofessional work were advising students to take law, medicine, education, dentistry, etc., according to the student's ability.

Whether or not the student was likely to make a success in the profession which he selected to pursue did not then and does not now, I believe, in many literary colleges, have much to do with the selection. Studies undertaken at that time, and continued until now, lead me to believe that the advisers to students in most literary colleges know much more about the types of students that are entering the different schools and colleges of our universities than we think they do. Apparently, comparatively few of the literary colleges doing preprofessional work are in a position to eliminate poor students, that is, those who do the minimum grade of work for graduation. They eliminate those who do not meet the minimum requirements for graduation, but these requirements may be low. It is those who are at the failure margin in literary colleges who furnish the trouble for the authorities of the literary colleges in these respects. As it is at present, Smith and Jones may enter one of our literary colleges together from a given high school with the same paper credentials and neither may have determined what he eventually intends to pursue. Father's or Mother's influence or that of both may have affected the principal of the high school in making out the transcript of the high school work for Jones. An overenterprising school board may have been anxious to have a large number of its graduates get into some preprofessional curriculum and *its* influence may have been brought to bear on the principal in making out the transcript. In any case,

Jones and Smith have enrolled in the literary college.

As they proceed in their work toward the end of the first semester, it becomes apparent that Smith is a better student than Jones, and as soon as this is discovered, Jones gets the advice that perhaps he could get through dentistry, but that it is doubtful that he can get through medicine or law. Whether Jones is fitted by inherent qualities to be a dentist, and Smith to be a physician or a lawyer, has little to do with it. It is a question of what the student in preprofessional work can get through, rather than for what he is best fitted. If the literary colleges could all determine, and would accept only those graduates of high schools who were in the upper half of the classes, the situation would probably not be so bad. As it is at present, there seems to be a problem confronting us much greater than the time that is to be devoted to professional study, and that is the problem of getting the literary colleges, the public and the profession of dentistry, and all concerned, to understand that the culls from the other professions can no longer fill the classrooms of dental colleges. We must give all concerned to understand that it requires just as fine an intellect to come into dentistry as it does into medicine or law, if we are to have real progress. Adding years to a curriculum, with a group of mediocre or low-grade students and a faculty with the training that was none too good for our older programs, is not progress at all. This is vanity from which the veil has yet to be removed, and the real problem has yet to be discovered. I hear some say that time will do it, if we are only patient, but let some one come forth with the evidence. We must not forget that the profession of dentistry requires much hard work in order to succeed. Moreover, there is that traditional experience of nearly all educators confronting us, that some of those with the finest intellects would rather work with their minds than with their hands.

In other words, we have not yet found out whether those with the finest intellects will pursue the profession of dentistry in adequate numbers to meet our needs; with evidence accumulating to show that the general need of it is increasing. We are now at the crossroads with the two years' requirement, and the experiences that we have had at Michigan with two classes that have been admitted upon this basis show that it is just as bad as and, in a few respects, worse than the one year requirement, as far as a guaranty of student ability is concerned. We have made what we think is a little progress with the problem, for we have a list of eight colleges in Michigan and several in surrounding states doing preprofessional work and from which we shall in the future refuse students unless we can have a personal interview and a statement from the high school authorities assuring us that the applicant was not a poor student in high school. We have just dropped eighteen out of ninety-eight freshmen and placed about a half-dozen on probation for the second semester. We ordinarily like to get about 100 in a freshman class for we can do a good grade of work with this number. This year we admitted 101, and three dropped out before the end of the first semester, leaving us 98. It may be seen that the dropped and probation students constitute about a quarter of the class. The probabilities are that of the remaining eighty, from six to ten will fail to meet the standards which we are trying to maintain, and will be dropped at the end of the freshman year. There will probably be from ten to twenty of the re-

mainder whom we shall wish that we had been able to eliminate, and would have if we had had the administrative machinery to do it, leaving about 60 per cent of the original class that can do a good grade of university work.

When it is taken into consideration that the original class of 101 was selected from upwards of twice that number, it may be seen that not more than from 30 to 35 per cent of those who first applied were qualified to do a grade of work that is now being required of students of medicine and law and some of the other professions. With this condition prevailing, a pertinent question would seem to be: What is the real object to be attained by adding a fourth year to the dental curriculum? Does any one with an intimate knowledge of the subject think that the condition will be improved by the addition of a fourth year? My experience in the examination of many schools, since some of these observations have been made, has convinced me that this condition is not so good in most sections of the country as it is in Michigan and the surrounding states. While some may regard it as a breach of confidence to make this statement (I hope that no one will), it seems in the interest of dental education to say that in at least two schools now operating on a two and four basis, the condition seems to be much worse than it is at Michigan. In fact, it appears, in my opinion, so bad that any amount of addition to the time requirements will not enable the faculties of these schools to maintain standards which will convince one that dentistry wants its share of the inherently bright students, unless there is set up some effective admission machinery, and then time only will tell whether these schools can obtain the students in adequate numbers under such conditions.

A dean of another school now operating on a two-four basis recently asked me if we really intended to graduate a class on the two-three basis, and added that he was astonished to see us trailing in the rear with certain other schools that he mentioned as constituting the rear. This same dean urged me to assist him to find a suitable person for a dean of his school, for the reason, as he said, that he was unable to give sufficient attention to the work of dean. He also told me that our school or any other school turned out no better students than his. "We are in fine shape," he said. "All we lack is a full-time dean." In this same school, there is almost no research except in the fundamental sciences, which are taught by the medical faculty, and it seems safe to say that what is taught by the dental faculty would have to be reorganized immediately, were there to be instituted in this school a genuine spirit of inquiry. These statements seem to be interesting illustrations of how some persons think along educational lines. The probabilities seem to be that if a full-time dean were to be appointed, and if he knew education, the first things to be discovered would be that the students in this dental school were inferior to those in the other professional schools of the university, and that the same spirit of inquiry did not exist in the dental school that existed in his medical school and other units of this university. At least, these are some of the things that deans have been known to discover when they have the time to study their job and their product, and it seems that there is opportunity for their discovery in this school. If this school were as good as any of the others, as was claimed, why get a full-time dean? Or why not appoint some of those already in the school who are said to have made

it as good as the best, instead of continually looking about for new material?

This dean apparently thinks that a four year curriculum following a paper requirement of two years of literary work has put on the finishing touches, and that the rest of us may be designated as trailers because we let the length of the curriculum take care of itself until we find out what a good faculty can do with some good students with less redundancies in our curriculum. There is a very old saying that "an organization is no better than the head of it" and were this dean to follow Lowell's suggestion about looking into the well, he would have a fair image of the organization of this school.

Robert Shafer, in his book entitled "Progress and Science," says, "If one asks what are the bases of progress, what its path, what does perfection mean—to these and the like, one gets no united answer. Answers are loud enough, but they are various."

Some of those who are so certain that they have found the bases of progress, the path and perfection in dental education, that they can designate as trailers those of us who disagree with the length of their program, may well study Schafer's questions before they answer so loudly. Schafer asks, "What are the bases of progress, what its path?" and "What does perfection mean?" It would seem safe to venture the statement that all those concerned with the different curriculums now in operation in this country would agree that the service which dentistry renders entitles it to be placed among the best of the professions. If all would eliminate for the moment any thought of length of curriculums, character of admission requirements, etc., they would probably agree that if we place dentistry among the best of the professions, we must get into it strong men; men who are alert and progressive when compared with the other professional men in their communities.

This would be the perfection to which Schafer alludes which would, in a general way, satisfy all concerned. It is the basis of progress, and its path, about which we differ. What we want to accomplish seems to be agreed on, but how to do it is not. This seems to be a perfectly natural condition to expect, in view of the fact that dentistry has been, up to this time, so largely a practical profession without the educational guidance which the other professions have had. Since 1916, our professional curriculum has changed but little, but we have been putting fundamental studies ahead of it almost constantly since that time. In other words, we have been going backward in order to go forward. At first, college biology, English and chemistry were required; then college biology, English, a foreign language, chemistry, physics and some elective studies.

Law and medicine are having the same experiences at the present time. Some of our best law schools have found that it is better to add to the entrance requirement than to the professional one. An arts degree for admission and a three years' professional curriculum appear preferable to a four-year professional curriculum. You are probably familiar with the discussions which have been, and are now, occurring in medicine about the wisdom of a shortened curriculum, increased facilities for graduate work and more honor points for admission. Many of the great industries have likewise been obliged to go backward for a while in order to go forward. Automobiles and other machinery and appliances which have disappointed the makers when put to practical use have been made

almost perfect by the application of the microscope and other physical testing equipment during manufacture. Each year brings an increase in the application of the fundamental sciences to manufacturing.

One could enumerate an almost endless list of illustrations of the application of the fundamental sciences to the things involved in our work and pleasure. There have been placed in the book shops many such books as "Marvels of Science," "Science Remaking the World" and "New Era in Chemistry," which have served to inform the public, in a general way, of the general trend of things. The result is that we find now not only many men with formal science training in business, but also many with informal training who have senses quickened to things scientific. With a rapidly developing public to meet and with whom to deal, and with a more careful selection of the men in the other professions with whom we are to be compared, it would seem beyond a question of doubt preferable for us to concentrate our attention on the entering product rather than on how to justify a four-year curriculum of professional work. In other words, there seems to be no reason to expect dentistry to command the respect either of the public or of other professions if we fill the dental offices of this country with persons who do a poor grade of work in high school, in literary college and in the professional school, even if we do require a maximum length of professional curriculum. They are, currently speaking, just dead ones, and they will always be rated as such. No amount of professional work will make of them the kind of a person that Bobbitt, in his book entitled "Curriculum," describes as one with "enriched mind, quickened appreciations, refined sensibilities, discipline, culture," as an educated one.

As I have stated, it is sometimes discouraging to think that possibly there is too much hard work connected with dentistry to enable us to attract, in adequate numbers, those who can maintain professional equality with the other professions, but there are some encouraging features, the most prominent of which seems to be the fact that we have not taken a stand and said that we will no longer have the culls from the other professions, and we have not tried it out. Perhaps I am too familiar with educational traditions, which show that those who work easily and effectively with their minds prefer to do so, while those who do not work well with their minds work with their hands, to be able to assume a condition of optimism about our two-year college requirement for admission unless it is accompanied with the firmest kind of administration. The fact that we have not declared ourselves, and thus have not shown what we think of ourselves, and the fact that there are an increasing number of possibilities for the use of both mind and hands in the service which we render, offer opportunities for the attainment of the ideals on which we probably agree, and leave the doors of experimentation wide open to us.

The differences between us today concerning the bases of progress and the path are probably largely due to failure to appreciate fully the fundamentals of education and of educational progress. Bobbitt, in his book on curriculum making, says:

> There are many who delight in any kind of a change, and feel that they are making progress when they are making changes. But merely shifting position is not necessarily progress. There are more ways of going wrong than of going right. The status quo is usually better than changes in the wrong

direction. Curriculum-making must find guiding principles which lead it with all the certainty that is possible in right directions. It is helpful to begin with the simple assumption, to be accepted literally, that education is to prepare men and women for the activities of every kind which make up, or which ought to make up, well-rounded life; that it has no other purpose; that everything should be done with a view to this purpose; and that nothing should be included which does not serve this purpose. Education is primarily for adult life, not for child life. Its fundamental responsibility is to prepare for the fifty years of adulthood, not for the twenty years of childhood and youth.

Keppel, in his book on education for adults, says:

I submit that there is no more important objective for formal education than to prepare the student's mind for the need and practicability of continuing the process. Without this we shall never know what adult education might achieve did it not have to use so much energy in the unnecessary process of restarting the train.

We have been restarting the train since 1916 by constantly placing fundamental studies ahead of our professional curriculum, and some of those who appear to be not only optimistic but also certain that they have the answer to our problems in the two-four plan will be restarting another train when they discover that the greatest problem that has yet confronted dentistry is to get the naturally bright students in adequate numbers. They will find that they have to go back to the day of admission if they wish the fifty years of adulthood to which Bobbitt and Keppel and others refer to be a credit to the profession. Many other references of a similar nature could be made, all of which show that curriculum-making is not a thing to be tossed about like a football. Curriculums should be built upon needs, their builders keeping in mind all the time what Bobbitt says—that there are more ways of going wrong than of going right. Has anyone shown the need of a four-year curriculum yet, provided a high-grade two years of literary work was required for admission? Certainly not. Is it, as one dictatorial medical teacher puts it, because medicine fuddled around with all kinds of curriculums and finally landed on the two-four plan? Perhaps this may be true in this particular case. At least, no one has yet come forth with anything appearing to be educationally sound, to show that four years are necessary, provided two years of literary college work be required for admission and provided the students have ability.

I imagine that some one is saying, "When is he going to tell us about how he is getting along with the two-three-graduate plan?" In anticipation of such a situation, I will say that we are getting along about as well as could be expected in view of the fact that we are studying the job that is to be done and the material with which we have to work. How it is to be done is not interesting us so much now as it may later.

As a result of studying the job and the material with which we have to work, we have learned many things which may be reported as progress of a substantial nature. For example, we have found the principal reasons why so many students with poor and mediocre ability are applying for admission to dental schools. We have learned that some, and perhaps many of the literary colleges are not in a position financially to maintain the standards that they desire, nor are they informed that dentistry will not have the poor ones. We have learned that reduction in the time devoted to technics, substitution of a small amount of work in the physical sciences and insistence on a higher quality of work have improved the ability of the students and left available large amounts of time to be devoted

to other things. We have learned that high standards of scholarship cannot be maintained with large numbers of students of low and mediocre ability in the school.

We have formed the opinion that should the time now devoted to the study of dentistry beyond high school prove too short, it had better be lengthened by adding a third year to the literary work than by increasing the length of the professional curriculum, and that this third year should include advanced organic chemistry, advanced physics, general metallurgy, social science and language.

We have learned that our standards, our methods and the material on which we work have not been entirely suitable to prepare for the fifty years of adulthood to which so many educators refer; and we have learned many things about how to create a spirit of inquiry throughout the school, even in technical and some clinical departments, where it has been almost entirely lacking.

We have had no difficulty in carrying out our proposed curriculum for the two-three-graduate plan, for, as some of you perhaps know, it was built upon needs of our school during the years 1921-1926, when we were operating on the one-four plan. When the two-three-graduate plan was suggested by Dr. Gies in his survey of dentistry, we were carrying a full semester of literary work in our professional curriculum on account of demands for it as a prerequisite to certain professional courses. The change from one-four to two-three was little more than in name. There was in reality a change from a little more than one and one-half and three and one-half to two-three. This latter change was easily made by the elimination of certain redundancies in technics, making it practicable to leave the senior year in the two-three plan exactly the same as it was in the one-four. In other words, the two-three-graduate plan, as far as the calendar is concerned, is the natural outgrowth of study on the part of our faculty, of the actual needs of the students and the ability of the faculty to meet them. It has required only a little calendar readjustment to change the name from one-four to two-three.

Under such conditions, it might be easy for some to report excellent progress and appear certain of their relative values of progress, but it is not possible for us to do so until we can list with our accomplishments the attainment of a higher ideal—the winning of a higher percentage of the natively bright students and the establishment of a correspondingly higher standard of scholarship in the dental school. In the latter respect, we have discovered this handicap, but we cannot report the same progress as is possible with the calendar and some other aspects of our curriculum. J. B. Bury, of Cambridge University, that excellent writer of the book, "The Idea of Progress," says, "In order to judge that we are moving in a desirable direction we should have to know precisely what the destination is." In the same paragraph, he states, "The movement may be progress, or it may be in an undesirable direction and therefore not progress." In almost any direction that we turn for analogies and criteria as standards of judgment, we are confronted with such statements as, "What are the bases of progress, and what is its destination?"

Perhaps enough has been said (for a discussion which has been limited by those in charge of the program) about the necessity to convince all concerned that we want to reach a stage in our progress where we can attract our share of the bright and dependable students, but it would seem desirable to refer to

the possibility, if not probability, that our eighty years of independence from the natural growth and progress of other educational institutions, has caused many to adhere to the view that quantity of instruction determines quality of education. I have, on two previous occasions within recent years, referred to our experiences with courses in technics and I want to say again that the quality of technical work required of students, provided it is somewhat varied in character, determines far better what kind of work they will do in the clinics, than quantity does. Likewise, it will determine what kind of service is rendered during adulthood.

I have also referred to some of the differences which have existed in the nature of our other work. We have had those schools that required of the students a full dissection, and at least one prominent school that did only prosection. In the same school that required only prosection, quantitative chemistry was required, while some of the best of our schools held to the view that this subject was not descriptive enough in character to justify its being made a requirement in an undergraduate dental curriculum. In some schools, physiology laboratory work has been required at the same time that others have regarded this work as too largely a glass-blowing and setting-up equipment affair to justify its insertion into an undergraduate curriculum. In some places pharmacology has been developed to a considerable degree as a required subject, while others have regarded it as so limited in its application that long courses were not justifiable at this time.

During the period that some of the schools were pioneering with the one-four plan, one school required the subject of physics in the professional curriculum because there was no room for it in the preprofessional one, and, in this instance, the importance attached to this subject by some of the teachers of the fundamental sciences was so great that high school physics and at least trigonometry were required as prerequisites to this subject. It was contended by some of the teachers of the medical subjects that neither chemistry nor biology could be well taught to students who had no college physics, and the best teachers of the fundamental sciences that we have today are going as far as to suggest that physics should be required before either chemistry or biology is undertaken. Furthermore, the subject of physics was regarded as so important in the development of almost everything mechanical that for dental schools to neglect it as most of them were doing, and had been doing on the one-four plan, seemed like wasting time on technics which could be better utilized in other things.

We could go through practically all the courses which have been required for graduation and give similar illustrations of differences in the scope and quantity of instruction that have been required for graduation, but who knew that these differences existed except a few who have had opportunity to observe them? Certainly no one has observed these differences in the graduates of the schools where these differences have existed. Education is not acquired that way. A little more of this or that thing will make no difference in the ability of the student at graduation nor of the dentist during adulthood.

On the other hand, if we ask whether quality of work has reflected itself in the qualifications of graduates, we must answer in the affirmative. There are some of the dental schools in this country which have the fundamental studies taught in the medical school, and the

teachers in these medical schools have acquired reputations as good teachers with high standards, not because any one knew these teachers, but because the qualifications of the students told the story.

There is one place where a course of moderate length is given in a fundamental subject, and yet some of the dental schools which maintain longer courses in this same subject send students to take the shorter course. They have learned that the teacher who gives the shorter course gives credit only to those who have entered into the spirit of study to such an extent and who are qualified to such a degree that they are prepared to continue this and related subjects throughout life if necessary. Unless we take the view that all courses of instruction are primarily to stimulate interest in the subject, which will continue, we shall fail to attain our goal. If some one had experimented with dental students and shown that some of the work required of medical students was not redundant for dental students, our situation might be different. As it is, the glass-blowing, physiology and the full dissections and some other things have been adopted without sorting out the chaff, which has been coming along with the wheat in the development of medical education. This may be the mode and temporarily gratifying, but the time is approaching when the more fundamental problems will force themselves into the foreground; for, as Mr. Fosdick recently said, you cannot purify the water in the well by painting the pump.

THE TWO-FOUR PLAN*

By WILLIAM RICE, D.M.D., Boston, Mass.

ON his return from the United States in 1876, after attending the medical congress at Philadelphia, Lord Joseph Lister made the following comment in referring to the state of surgery in America:

> Surgeons were educated on the same line as British surgeons; but the training was shorter and sadly deficient. Those who aimed at the higher positions were obliged to resort to post-graduate study, mostly in Europe, and gained their clinical experience on their return. Then began the high-pressure existence of that "New Country" and they became essentially practical surgeons—carftsmen in the best sense of the word, devisers of new operations, improvers of surgical technique, and naturally indisposed to trouble very much about abstruse scientific problems. But when it had been proved elsewhere that the new method had practical value, it was quickly taken up and successfully applied. [Antiseptic surgery.]

The age of the division between the practical and scientific has to a large extent passed. The scientific is no longer regarded as speculative, and the practical man does not worship the idol of the rule of thumb. Science and practice have become unified in the arts, manufacture and medicine, and even in religion gleams of scientific knowledge may be discovered. It is in recognition of the

*Read at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 25, 1929.

consummation of this portentous development that dentistry has come to realize the necessity for an introspective study of its educational methods and standards in order that they may be properly evaluated, then improved and readjusted by deletion or amplification as the case may require, that they may meet the requirements of the best known in professional education of the present day.

It was for this reason that the Association of Dental Schools of American Universities in 1920, through a committee of its members, requested the Carnegie Foundation for the Advancement of Teaching to undertake a survey of dental education, to be followed by a report of its findings, for the consideration of the various dental schools in the United States and Canada. The result of the survey by William J. Gies, who was appointed by the Foundation to carry it on, is well known to all. The publication of Report No. 19 marks an important epoch in the history of dental education.

It is not the purpose of this paper to discuss the many recommendations contained in this report. It was inevitable that all its recommendations would not meet with universal approval in the minds of the leaders in the various parts of North America. In certain sections, educational conditions might be such that it would not be feasible to carry out the plan for more extended preliminary education. In addition to this objection, the great need for dental service might not be met after the reduction in the number of graduates in dentistry which would inevitably follow the adoption of higher preliminary requirements. It was also to be expected that the conception of dentistry as a profession separate from medicine would meet with opposition by those schools most closely affiliated with medical schools.

Dentistry was aptly termed a health service, and the question immediately arose: Is not this also the identical function of the conventional specialty in medicine? The dentist is concerned with the preservation of health and the rational treatment of pathologic conditions. So is the physician. Has the fact that one specialty requires more mechanical training than another anything to do with the nature of the problem in general? Medicine is a health service; dentistry is a health service. To consider it in a separate category seemed in the minds of many to be a distinction without a difference. In my own mind, I cannot escape the thought that dentistry (exclusive of technical procedure) is medicine, and the reconstructive problems in medical education are also dentistry's problems, and that training in technical proficiency in intra-oral procedures essential to the practice of dentistry is comparable to that which should form a part of the training of the specialist in other branches of medicine, particularly those specialties involving mechanical problems and manipulative facility. Assuming that dentistry is a branch of medicine, closer affiliation should be sought with the educational bodies connected with the American Medical Association. The beneficial effect of such association is obvious, for the record of the experience of dentistry since its separation from medicine affords a valuable object lesson on the disastrous results of the mechanistic conception of the past, which has shaken the confidence of the medical profession and caused them in many instances to renounce the dentist and all his works.

The third report of the Commission on Medical Education states:

> The specific medical school requirements should be confined to the fundamentals of biology, physics and chemistry. If premedical education is to meet its responsibilities in

relation to general education, the medical schools should co-operate to avoid prescribing that training in such a way as to defeat the development of intellectual self-reliance and broad cultural interests in the students which are now the outstanding criticisms of premedical education.

In a similar vein, President Vinson of the Western Reserve University has said, in his excellent monograph on "Higher Requirements for Entrance to the School of Dentistry," in speaking of collegiate education:

> Its aim is the development of the individual rather than training for the thing he is to do. It sets out, not to prepare him for any one specific thing, but to make possible his later preparation for any one of many careers. The entrant to the vocational school has chosen a narrow single road which he must follow between narrow borders or retrace his steps; the entrant to college is for at least two years in a broad plaza from which many broad roads diverge, one of which he will later select. Collegiate work demands more than secondary school work, a greater ability, a broader judgment, more earnestness and ambition, a developing purpose, a desire to achieve. The college is a maturing experience. It is selective, especially in its first two years, for these two years are demanding enough to sort out those lacking in talent, but who have succeeded in the secondary school through perseverance alone.
>
> It is a maturing two years, and each of the two years is complementary to the other.

I am convinced that these conclusions represent the best thought in preparation for dental education as well.

The student under the two-four plan enters the professional school in greater maturity of mind and body. He has arrived at a period when he has, in a measure, found himself and is capable of meeting the varied experiences in life with a better understanding of their significance. He has developed a sense of discrimination and is better fitted to decide the question of his life work. Having made his decision, he is more likely to take up his course of professional training with a high conception of its aim and purpose.

The air of incredulous skepticism so characteristic of the dental student in past years with respect to the so-called theoretical courses is gradually passing, although the tradition still prevails that these subjects are merely stumbling blocks which clutter the road to be passed over before reaching the main highway of real dentistry.

It is obviously too early to answer with any degree of finality the main question which I have been asked to discuss: What does the progress to date reveal in relative values of the one-four, the two-three and the two-four plans in dental education?

I wish to state here that I see no insurmountable objection to the completion of the professional course in three years under the four-quarter system when conditions are such as to make it possible to provide instruction of uniform grade throughout the year.

The established custom of closing the academic year in June and beginning the next session late in September is undoubtedly wasteful from an economic standpoint. This custom has its advantages, however, for, if the time is intelligently employed, it serves as a period for recreation, education, orientation and preparation for the ensuing year. To arrange for the absence in rotation throughout the year of the professorial staff for an equal period of time is a difficult problem, especially so at the present time when the dearth of properly trained teachers is perhaps the greatest handicap to the successful correlation of science and practice in dental education. The two-three-graduate plan, which is based upon the elimination of certain subjects from the undergraduate curriculum and the re-

construction of many courses, with the omission of much which seems to have but little bearing on the actual practice of dentistry, is an interesting experiment and one which should be regarded seriously and open-mindedly. Tufts College would have tried out this plan had it not been that the laws governing professional education in the state of New York made it inexpedient.

Thomas Huxley has said, "The assertion that outstrips evidence is not only a blunder but a crime." I shall, therefore, make no positive assertions but shall present reasons which seem to me to validate the statement that the two-four plan of education is an improvement on any plan hitherto considered. This evidence is necessarily more significant than conclusive, as it is based on but two years' experience, under the plan in the dental school which I represent.

What, then, are the advantages of the four academic years? First, there is sufficient time to give courses in the medical sciences which are equivalent to, if not identical with, those given in the courses in medicine. It will be asserted by some that there is much redundancy in these courses and much detail having little bearing on the ultimate aim of dentistry. This is undoubtedly true in both medicine and dentistry, and is recognized by the leading educators. In the reconstruction of the program for the first two years in the professional school, it would be wise to join with medicine in the effort to arrive at a solution which will make these first two years of more permanent usefulness in practice. What has been termed the "water tight compartment" idea, which has been predominant in both medical and dental training, is now before the bar of reason and will undoubtedly be found wanting.

Science and practice should be inseparable. The student should early in his course have the opportunity to live in the atmosphere of practice. He should have hospital experience, not only in the dental clinic, but in the wards and surgical clinics as well. At the present time at Tufts, senior dental students are assigned in sections to the hospital with the medical group, under the direction of the chief of staff. They are taken into the wards and instructed in bedside routine and treatment; they put on gowns and masks and are taken into the operating room to learn surgical procedure and to witness operations.

Students so trained who have repeatedly passed through these experiences exhibit far more intelligence in all their professional work. When they are called on to take charge of cases in hospitals in the course of practice, nothing will be strange or new to them. They will have an assurance which nothing but actual experience can give.

The four-year course affords time for ample and thorough courses in all subjects relating to dentistry. There is also time for subjects, not directly related to dental practice, which will add immeasurably to the usefulness of the dentist in the community which he is to serve. Particularly is this true of the courses in physical diagnosis, first aid, hygiene and sanitation, oral diagnosis and the practice of medicine. These subjects I deem as essential to a broad and helpful community service as are operative dentistry and prosthetic dentistry. Such a curriculum requires time, not only for class work but also for study and assimilation. The development of habits of reflection and individual initiative in training are never an accompaniment of haste. Development requires time—periods of rest as well as those of activity. The feeling

has prevailed in the past that vacancies in the daily schedule were inimical to the best training. No less an educator than Harvey Cushing has deplored this state of affairs in medical training. Time must be allowed for recreation, physical exercise and rest, if the student is to maintain a fitness of mind and body which will permit him to give the best within him to his work. A past president of the American Medical Association has said, "Most of us have been so indoctrinated with the virtue of industry that we feel critical of ourselves when we indulge in any leisure of this sort. As a matter of fact, it is one of the most fruitful things in life and one of the most pleasant." Helmholst said, on his seventieth birthday, that his best ideas had come to him, not when he was at work or when he was tired, but when he was at leisure and musing of other things.

I do not think the best can be accomplished in three years. If the graduate year should become anything like universal, it would still necessarily be devoted to subjects omitted in the three-year course and to a broader training in the related sciences.

In order to make my conclusions less personal, I wrote to the members of the teaching staff of Tufts College Dental School who have under their instruction at the present time students who have received two years of college training and are now taking the four-year course, to get their reaction, hoping to present a conclusion that would be composite rather than individual. The assistant professor of prosthetic dentistry states: "Students are appreciative of a professional training and exhibit a more serious attitude toward it. The general morale of the classes is greatly improved."

The professor of chemistry says: "I notice no marked improvement in the students of the first and second year of the dental school who have had two years predental training over those who had only one, other than the one year's added maturity."

The professor of physiology says: "I believe that teachers of the fundamental sciences can best appreciate the advance in admission requirements. We have a better opportunity to test out the students' educational background than the clinical teacher because of the application of his collegiate training to the professional course. I believe the present-day student with his two years of college work and four years of professional work is better fitted to practice dentistry and will prove of greater value to the public."

The professor of operative technic writes: "Men are of higher caliber intellectually and morally, and show greater capacity for self-education. They exhibit to a greater degree those special attributes which are essential to one devoting his life to a professional career than do the students who have had one year of college training. This I attribute to the broadening, refining and cultural effects imparted by the additional year of academic work. As far as technical skill is concerned, I have not observed any improvement, but they develop this skill very quickly and apply it more intelligently to the solution of the mechanical problems of dentistry than do the one-year men. They approach problems more scientifically, and with a questioning mind; they exhibit a greater thirst for knowledge, are more serious and studious and manifest a keener interest in the profession. The improvement is so marked that I feel that the judgment of those who have advocated the additional year as a requisite for the study of dentistry is more than justified and any retreat would be a step backward."

The professor of dental history states: "The present first-year class handed in the best examination papers I have ever looked over. Their average is higher than that of previous classes. They convince me in the lecture room by look, bearing and general intelligence that their training surpasses that of previous classes—an impression which has been strengthened by personal contact with individual men. As to technical work, I can make no definite statement. Feeling as I do that the membership of the two classes in question is not only better trained but has a higher capacity, naturally I should look for quite as good results as heretofore when the question is one of manipulative skill."

The professor of anatomy writes: "Since we now unquestionably have students with better trained minds and hence with greater capacity for learning, with deeper regard for their teachers and their work, and with a keener sense of honor, it behooves us as teachers to play our part, living up to the standards which these men have a perfect right to expect."

The four-year course affords time for individual effort along special lines. That evidence of this is not lacking is shown in the selections of topics of papers by undergraduates for the school magazine, in the subject matter contained in the papers and in the bibliographic references. Such subjects as the following are indicative of a radical departure from those of bygone days: "Psychology of Pain," by Anderman; "Evolution of the Human Mandible," by Gottlieb; "The Value of an Academic Education," by Foley; "Dentition and Characteristics of the Java Ape," and "Reflex Disorders of Dental Origin."

While it might truthfully be said that these papers give little evidence of original thought, no one will question the fact that the pursuit of knowledge concerning a subject requiring a wide range of reading is beneficial in the effect on the person so engaged, and is significant of a questioning mind, not content with arbitrary statements of fact. At Harvard University Dental School, several undergraduates have been engaged in the study of problems which rightfully come under the term research. I had the pleasure of listening to a report of a demonstration of anaphylactic sensitization in hypersusceptible guinea-pigs, sensitized through the teeth, which was a very commendable effort. It is mentioned as having a bearing on the necessity for free time, especially during the senior year, for elective work.

BLOOD EXAMINATION IN THE PRACTICE OF DENTISTRY*

By IRWIN A. EPSTEIN, D.D.S., St. Paul, Minn.

THESE days when dentistry is being given more recognition as a specialty in the healing art, the general public as well as those of the medical profession are relying more and more on dental practitioners for the prevention, recognition and treatment of conditions in the mouth with reference to disease elsewhere in the body. The dentist finds himself confronted not only with the problems of putting the mouth in a healthy condition but also of knowing something of the relation of general health to mouth health as well as mouth health to general health. Many types of systemic diseases have early manifestations in the mouth which should be detected by the dentist and other conditions which should at least arouse his interest as to their possible origin.

Those who specialize in the eye and its diseases are able to discover early manifestations of certain systemic diseases by examination of the eye grounds, so that general treatment can be instituted early in the course of the disease. Most dentists are unable to do this by examination of the mouth, and are being criticized because they do not know the pathology of many of the conditions which they are commonly called on to treat. The tendency in dental education to stress the mechanical side of dentistry must be taken into account here, because of the nature of the bulk of the work that the practicing dentist is called on to do. The health side of dentistry is a newer obligation which dentists must be prepared to assume.

The dental management of cases presenting systemic disease is exacting, and it becomes important to know what type of patient one is dealing with when contemplating such procedures as periodontal treatment, surgery, root canal operations and extensive undertakings in reconstruction in order to know what is best for the case at hand.

That blood examinations should be included among the various diagnostic procedures to round out this picture of the patient in oral diagnostics has been emphasized by many writers, but little has been said regarding the clinical conditions coming under the observations of the dentist which particularly call for a blood examination, and even less mention is found regarding the interpretation of the findings after they have been obtained. The diagnostic methods which are now in general use by dentists are not all employed routinely in every case presenting itself for dental observation, for each test is selected to be used whenever and wherever the experience and judgment of the operator dictate.

*From the Division of Dentistry, Medical School, University of Minnesota.

*Read before the Section on Oral Pathology at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

Examinations of the blood are not indicated in all dental cases. There are many abnormal mouth conditions which are indirectly or directly caused by systemic diseases that are seen frequently by dentists before the patient or his physician knows of such a condition, and in which the circulating blood is so altered that examination of it will either determine or aid in the diagnosis or assist in determining the prognosis of the disease. The dentist has the right in such cases to order an examination of the blood and is distinctly obligated to do so. It is not essential that the dentist or his assistant be skilled in the technic of making these examinations, but he should at least know the more important normal blood values and something of the significance of deviations from normal. Patients can be referred to physicians and pathologists for the examinations. The value of written, signed reports from recognized sources in the graver conditions hardly needs elaboration.

For some time, I have been interested in attempting to evaluate the practical uses by dentists for the legitimate blood findings in common use, including the hemoglobin determination, total and qualitative red cell count, total, qualitative and differential white cell count, the blood platelet count and the bleeding and clotting time. It is the purpose of this paper to point out the types of mouths in cases in which blood examinations will commonly reveal systemic conditions which may require special preparation or demand careful medical attention and cooperation before dental operations are performed and which may give rise to anxiety and embarrassment to the patient or the dentist. Further, we wish to suggest how the findings may be used in planning dental procedures. Obviously, this includes much that cannot be discussed in the time available.

One of the most suggestive symptoms which at once indicate the necessity of a blood examination, if none has been made, is hemorrhage from the gums or mucous membrane without obvious and direct irritation or injury. This condition is usually one of the earliest symptoms of the various leukemias, scurvy, the purpuras or severe aplastic anemia, all grave conditions. From the dental as well as the general therapeutic standpoint, it is of the utmost importance that an accurate differential diagnosis of the condition be made.

Leukemias always terminate fatally, and the condition in the mouth, frequently at the onset of the disease, finds the patient seeking the services of the dentist first. In some cases of leukemia, the onset is rather dramatic, although careful inquiry will frequently bring out a longer history. The gingival troughs and spaces between the teeth are filled with a mixture of fresh and partially clotted blood. The lips may or may not be swollen. The tongue is usually heavily coated and sometimes sore. In many cases, the first sign may be an acute stomatitis with a swelling of the small lymphoid follicles of the gingivae. This is practically diagnostic of the condition. Leukemic infiltration of the gingival tissues may become so extensive that the tissues cover the teeth and protrude from the lips, and may be associated with necrosis and gangrene of the gums and mucosae. These necrotic areas are easily confused with mucous patches of syphilis and when these are present only to a moderate degree in the gingivae, while the condition is not typical clinically of Vincent's infection, it is commonly diagnosed and treated as such. Smears made from these areas reveal spirochetes and

fusiform organisms in great number. Swelling and pain in the submaxillary glands frequently fits in with the general picture to further confuse the condition with Vincent's infection. All cases of Vincent's infection which prolonged, thorough treatment does not clear up call for an examination of the blood. Acute gingival hypertrophy due to infectious processes and the proliferative gingivitis of pregnancy also must be included in the list for differential diagnosis. Leukemia is then quickly differentiated from the above named diseases by a diagnosis which is based on the qualitative differential leukocyte count alone. Although cases have been reported in which the total leukocyte count has remained within the normal limits, the count typically rises high in the thousands of cells per cubic millimeter. This should indicate the possibility of leukemia. However, the final diagnosis as to the true state of the condition is made from the state of immaturity of the particular series of leukocytes affected, and the disease is named after that series, i. e., lymphatic, myelogenous, monocyte leukemia, etc. Any blood smear with more than 15 per cent of myelocytes should be carefully examined for promyelocytes, leukoblasts and myeloblasts.

Conditions in the mouth in leukemia frequently call for immediate symptomatic treatment. Extraction should be resorted to in cases of pain, only after every other method of alleviation has failed, and then not without a definite understanding with the physician and near relatives, regarding the possible sequelae. Many cases are apparently chronic or subacute, and following some minor procedure, such as the removal of teeth, become extremely acute and continue a short rapid course until death.[1] Irritating preparations are to be avoided in all cases of leukemia with gingivitis, stomatitis and areas of ulceration and necrosis. The actual cautery, concentrated chromic acid, silver nitrate, and trichloracetic acid are without avail, and are strongly condemned. An effective agent is hydrogen peroxid diluted in two or three parts of water. It tends to check bleeding, cleanses sordes and washes clotted blood away and is inhibitory to the growth of the organisms in the ulcerations. Spontaneous bleeding from the free gum margins is usually not controlled by any means for more than a few hours.

Spontaneous hemorrhage from the gum margins is also usually one of the earliest signs of the purpuras. In the early stages, ordinarily cases of purpura do not present the symptoms of anemia. The only other sign which may accompany the bleeding is the presence of numerous petechial hemorrhages in the soft palate and mucosae and not infrequently the tongue. After a time, if the hemorrhage goes on unchecked, signs of secondary anemia will appear. Petechial hemorrhages on other parts of the body may or may not be present at the time the patient is first seen by the dentist. These should be inquired about. All local therapeutic measures to check the bleeding will usually fail. Intramuscular injection of whole blood is the most effective systemic means of checking hemorrhage in purpura hemorrhagica. After such treatment, the local bleeding ordi-

1. Hill, H. P.: Acute Leukemia and Agranulocytic Angina Associated with or Following the Removal of Teeth. California & West. Med., 25:609 (Nov.) 1926. Isaacs, H. J.: Acute Lymphatic Leukemia: Relation to Minor Surgical Procedures. Report of a Case, Dent. Cosmos. 67:953 (Oct.) 1925. Rosenthal, Leonard: Oral Symptomatology of Acute Lymphatic Leukemia, with Case Report, p. 247.

narily stops. One case came under my observation in which extraction of the remaining teeth had been advised in order to stop bleeding from the gums. Such a procedure certainly should never be carried out.

Hemophilia, which is an inherited tendency of males to bleed, is another systemic condition which is met with by dentists. This condition also is characterized by a great tendency to bleed after minor operations such as the extraction of teeth and minor bruises. Here, the history is of importance. The disease occurs only in males and is transmitted only by females, who can never have the disease. There has not been a proven case of hemophilia in females, although they frequently do have diseases with hemorrhagic diathesis. Of the females who can transmit the disease, 81.3 per cent do so; 51.0 per cent of the possible males have it. There are no morphologic blood changes due to the disease, but occasionally regenerative changes may be seen.

Until the process of clotting in hemophilia is understood, there can be no rational therapy. Local treatment is as a rule ineffective. The feeding of calcium lactate is not satisfactory (although the usual therapy in cases with jaundice is calcium lactate 5 grains three to four times daily for four or five days). The only therapeutic measure worth while is transfusion. The coagulability of blood after transfusion reaches its maximum at six hours and in thirty-six hours has returned to its original condition.

In a known case of hemophilia, the best time for extraction is a few hours after a blood transfusion. Usually, the hemorrhage following dental operations is negligible and causes little concern. Obtaining the history of the patient's tendency to bleed should be a routine procedure in every dental office before the removal of teeth. Those presenting a questionable history of bleeding should have a bleeding and clotting time determined, and if the findings from these two are greatly at variance from normal, a platelet count and examination should be made of the character of the clot of drawn blood.

Unfortunately, these conditions are more often discovered by the dentist, after extraction, surgical pyorrhea treatments, etc., than before. Patients who bleed persistently after local methods have been without avail after extraction should have a blood examination made either to indicate or rule out the possibilities of jaundice, purpuras, hemophilia, leukemia, etc. Local methods for controlling bleeding following minor oral surgical procedures have been well described by Winter and Darlington,[2] Zemsky,[3] Duke[4] and others. They will not be repeated here.

The clinical syndrome which accompanies acute hemorrhage resembles that seen in surgical shock, and the treatment is the same. The symptoms are pallor, rapid, feeble pulse, rapid, shallow breathing, restlessness, sweating, vomiting, great thirst and clouding of the sensorium.

The following factors are also to be considered: method of loss, amount, relation of lost portion to total blood of the patient, rapidity of loss, clinical state of the patient and state of the

2. Winter, Leo, and Darlington, C. G.: Control of Bleeding in Minor Oral Surgery Operation, J. Dent. Res. 6: 13-32 (March) 1924-1926.

3. Zemsky, J. L.: Bleeders; Bleeding and Means to Control It, Dent. Cosmos, 69: 39 (Jan.) 1927.

4. Duke, St. Clair: Treatment of Dento-Alveolar Hemorrhage Following Tooth Extraction, J.A.D.A., 12:1365 (Nov.) 1925.

blood-forming organs. The blood constitutes about one-thirteenth of the total body weight, and if one third of the total blood volume is lost suddenly, death usually ensues, while if two thirds is lost slowly, recovery is usually possible.

Every dentist should be familiar with the method of determining the bleeding and clotting time of the blood. It is a simple thing to do and requires no equipment that is not found in the average dental office.

The method to be used in determining the bleeding time may be stated in few words. Wash the lobe of the ear or tip of a finger with alcohol, and puncture with a needle so that the blood flows drop by drop without resistance or squeezing with the fingers. Note the time that the first drop appears. Remove each drop as it forms, with a filter paper or white blotter, without touching the skin. Note the time the bleeding stops. The time interval between the appearance of the first drop and the removal of the last represents the bleeding time.

Normally, the bleeding time is from two to three minutes. In jaundice, the bleeding time is prolonged owing to calcium deficiency. In purpura also, the bleeding time is prolonged. In hemophilia, it is normal. Bleeding time studies are usually made together with the determination of the clotting time. A drop of blood is collected on a watch glass or glass slide, or a grease-free BB shot or a globule of mercury is placed in it. When the blood jellies so that the shot is held in the clot, the time is taken. The time which elapses from the first appearance of blood until it has clotted is the clotting time. This is from five to six minutes. Another popular method for determining the clotting time is to draw some blood up into a fine glass capillary tube. At intervals, short pieces are broken off with a pair of tweezers. These are used so that the heat from the fingers will not accelerate the clotting.

When the blood has clotted, it will be easily pulled out of one of the parts of the broken tubing in the form of the inside of the tubing. Control tests should also accompany these. In purpura, the clotting time is normal and in hemophilia it is prolonged. In some cases of anemia, in leukemia and in some infectious diseases, the coagulation time is prolonged.

To further differentiate between purpura and hemophilia, the platelets are diminished in the former and normal in the latter. Platelet studies in hemophilia tend to show that it is not the number of platelets but rather the quality of the platelets that is the important cause of delayed clotting. In purpura, the blood clots imperfectly, while in hemophilia the clot is good but slow in forming. A capillary resistance test may be made by placing a band around the arm tightly so that the venous flow is obstructed. This pressure which is maintained for three minutes causes an engorgment of the capillaries. Hemophilias give a negative reaction to this test, while in purpuras, the reaction is positive. Petechial hemorrhages under the skin are the evidence of a plus reaction. Purpura will show capillary oozing at the point of entrance of a needle, while hemophilia will not.

The most common condition revealed by a blood examination is a lowered total red cell count and a corresponding lessened hemoglobin value, or anemia. This may vary from a slight reduction to a diminution of rather marked degree in the patient who comes to the dental office. The outstanding characteristic, in general, is pallor. Although

how far one is justified in diagnosing anemia solely from the presence of pallor is debatable (for it is well known that an individual may have anemia and no pallor and another have pallor without anemia), rarely does a person have anemia with normal color of the mucous membranes. Pallor may be noted also in the skin, lips, conjunctivae and finger tips by a pinkness that is different from the normal. In the mouth, the change of color is most evident in the alveolar mucosae overlying the lower front teeth and the mucosa of the palate. It varies from the normal translucent pinkness, through a lighter shade of flat pink to a milky, whitish pink shade when the hemoglobin is markedly reduced.

The alteration in color may or may not be associated with changes in form and contour of the marginal gingivae. Not infrequently, a slight tinge of yellow may be seen. Such alterations in color should immediately arouse the suspicion of the dentist as to the possible cause. In a great many indoor workers and delicate persons, the red cells count may be found to be around 4,000,000 cells per cubic millimeter, with a hemoglobin value of approximately 75 per cent during health. Such values need but passing consideration, but values below these warrant further attention. Patients should be questioned concerning their general physical welfare. Many of them will complain of tiring easily after exertion. A history should be taken before any surgical procedure in these cases to determine whether there is a tendency to bleed from minor causes.

Secondary anemia has been shown to be due to such causes as (1) loss of blood by hemorrhage; (2) suppression of the bone marrow activity by improper nourishment, unfavorable surroundings, toxic conditions and severe sepsis; (3) actual blood destruction by toxins and parasites, and (4) diseases of the blood-forming organs.

The blood findings in cases of secondary anemia show typically a lowered red cell count and a lowered hemoglobin reading. If the demand on the blood-forming apparatus is sufficiently great, some cells will be put into circulation before they have matured, and these signs of normal regeneration will be seen as cells which vary in size (anisocytosis), some with only part of the full amount of hemoglobin and with some of the blue spongioplasm remaining (polychromatophilia), and some with nuclear remains in them (nuclei and Jolly bodies). Many of the cells will appear pale (hypochromasia). When the process becomes severely toxic signs of pathologic regeneration and degeneration of the red cells can be seen in addition to the normal regenerative signs. Cells which are not typically round but are oval, pear-shaped, elongated, burlike and distorted in other ways, may be seen, (poikilocytosis). Basophilic stippling and nuclei with buds are frequently found, and if the toxicity is great enough, sometimes cells which are embryonic in character (megaloblasts), may be seen. Ample evidence can be found among published case reports that infection in the dental area is a causative factor in the production of secondary anemia as some cases show this to a marked degree, all periodontal infection should be eliminated in cases of secondary anemia, and until the status of pulpless teeth is determined, all teeth with pulp canal fillings are to be regarded as potential menaces and possible contributing factors in reducing general resistance, and hence are to be condemned. Areas of residual infec-

tion in edentuous mouths should be looked for as they are easily overlooked.

The eradication of the pyorrhea pocket, by either conservative or radical methods, has met with varying degrees of success in these cases. Many cases with low blood counts apparently respond to treatment readily, while others are retarded. The outstanding precaution here is to avoid the undue loss of blood following either extensive scaling or any other minor oral surgical operation, until the experience of the first sitting has been gained; at which time, little should be done.

Pernicious anemia is classified among the primary anemias, or conditions in which the anemia is the disease itself. Convincing evidence as to the actual cause is offered by several dissenting groups. By definition,[5] "Pernicious anemia is a disease of unknown etiology, showing a characteristic triad of changes in the digestive, blood and nervous systems and progressing, usually by remissions, to a fatal termination." The mouth syndrome associated with pernicious anemia, when present, is one that should escape few dentists. The mucous membrane is pale and sometimes is riddled with small areas of petechial hemorrhage. There may or may not be a manifestation of gingivitis. A recurrent soreness of the mouth and tongue not infrequently attends the disease. The tongue is extremely tender to heated or spicy foods and swallowing may be painful. Patients complain that the tongue feels "raw." The tongue may be quite reddened or may be anemic looking. This is not the usual glossitis that commonly accompanies other diseases, but an atrophic glossitis quite distinct from them. The papillae are uniformly wasted and shrunken so that the tongue has a generally smooth and atrophic appearance. This condition is especially well seen at the sides of the tongue, and because of it, the tongue is practically never coated in pernicious anemia.

I am indebted to Dr. Ulrich of the School of Medicine of Minnesota University for the "tongue blade test" for atrophy of the papillae of the tongue. Frequently, a tongue will appear to resemble the bald tongue of pernicious anemia. A quick stroke with the edge of a tongue blade along the side of the tongue will cause the papillae to stand out clearly unless they have atrophied. Needless to say, all cases do not show this condition of the tongue in the early stages of the disease. Blood findings with the characteristic neutrophil of pernicious anemia, neurologic findings, gastric symptoms or mouth lesions may be among the first manifestations of the disease to be noticed. Any of these may appear first.

The blood picture is of diagnostic importance. The changes include: erythropenia, hyperchromasia, polychromasia, anisocytosis, nucleated red cells, basophilic stippling, budded nuclei, poikilocytes, megaloblasts, megalocytes, relative lymphocytosis, with many degenerating lymphocytes, suppression of the neutrophils, characteristic neutrophils, altered monocytes and a hemoglobin index above 1.

The general treatment of pernicious anemia is now undergoing extensive modification. Nutritional therapy which has given the greatest promise of all the types of treatment is now being extensively studied. Under the influence of the liver diet or high vitamin diet, pronounced cases apparently return to such conditions as will permit the patient to

5. Cornell, B. S.: Pernicious Anemia, Durham, N. C.: Duke University Press, 1927.

be about at his usual duties in a short time.

The dental management of cases of pernicious anemia presents several interesting phases. In the literature, it has been claimed by many authors that oral sepsis can be listed among the possible causes of the disease. Careful work has shown that such is not the case. The feature which makes oral sepsis of serious consequence in pernicious anemia is the presence of lesions caused by specific organisms which allow of absorption of these organisms and their toxic products. These toxins are inhibitory of blood formation as is seen in the anemia of any septic condition. Septic processes tend to depress the activity of the red marrow and it is therefore necessary to remove any septic focus as soon as possible. Consequently, the presence of oral sepsis assumes importance when there is need for rapid blood regeneration to make up for the hemolysis that takes place in the disease under consideration. Ward[6] says "There is a great tendency to put off operations for the removal of septic foci until the patient is a little stronger. It is much better to let the patient lose a little blood from a tooth socket than to let him keep his septic focus."

With the present advance in the general treatment of pernicious anemia, few occasions will arise in which it will be necessary for the dentist to remove teeth while the total red count and hemoglobin count are extremely low. Of course, in these cases, caution must be taken to prevent further loss of blood after extraction. I have removed teeth, in one instance, with procain ("E" solution, Metz), in which the hemoglobin was 20 per cent and the red cell count 1,000,000 cells per cubic millimeter, with loss of little blood, while in others having higher blood values, considerable bleeding followed. A blood examination including a qualitative red cell count, total red cell count, hemoglobin determination and bleeding and clotting time is indicated before extraction as well as the cooperation of a medical advisor.

Local anesthetics need little modification from the usual formulas in general use by dentists in these cases of secondary anemia. The amount of hemoglobin in the blood is a modifying factor in the administration of a general anesthetic, such as nitrous oxid, which is so commonly used in dental offices. Hemoglobin is a respiratory pigment which is carried about in the red cells and which makes possible the carrying of oxygen to the tissues and the removal of carbon dioxid to the lungs, where it is again exchanged for oxygen. In cases in which the hemoglobin is diminished, the oxygen-carrying capacity of the blood is diminished in direct ratio to the reduction. Such a case will require less nitrous oxid to produce anesthesia; therefore, the best procedure is to use as much oxygen and as little nitrous oxid as will maintain an even anesthesia. This caution should not be overlooked in cases with less than from 45 to 50 per cent hemoglobin, when there is already a definite anoxemia. McKesson[7] and Heidbrink[8] have frequently emphasized this point.

The treatment of periodontal lesions may be retarded because of lowered resistance of the gums. The attempt at saving teeth with moderate or advanced pyorrhea is commonly not successful even

6. Ward, G. R.: Clinical Hematology, Philadelphia: W. B. Saunders Co., 1914.

7. McKesson, E. I.: Influence of Certain Diseases on Technic and Other Considerations of General Anesthesia in Exodontia, J.A.D.A. 16:18 (Jan.) 1927.

8. Heidbrink, J. A.: Personal communication to the author.

with the best of cooperation on the part of the patient as to home care. Some cases do respond well. Extensive bridgework and partial restorations are more likely to produce gingival lesions and fail in a short time because of this altered resistance. The disease runs its course in cycles, and there are times during which the patient is apparently free from any signs of the disease. These remissions may last from only a short time to a considerable number of years. The glossitis of pernicious anemia frequently persists during all but the most complete remissions, and exacerbation of glossitis may be the signal of a relapse. The atrophied appearance of the tongue remains. Any persistent glossitis which is not due to any demonstrable local irritation strongly indicates a blood examination.

Metallic poisonings commonly have associated with them a characteristic mouth condition. Of these, mercury, bismuth and lead are the most common. Blood smears are quite characteristic in poisoning by lead. Although cases are on record in the Minnesota University Hospital in which there were no visible alterations in the tissues of the mouth recorded, the findings when present all include the blue line of the gingival margin. The tongue may be slightly thickened, heavily furred and furrowed. The mucous membrane commonly shows a slight pallor, frequently accompanied by a slight cyanosis. The gums may be somewhat retracted from the teeth and have incorporated within them the grayish blue line typical of the condition.

With mercurial poisoning, there also may be a blue gray hue, but it is usually not confined to a definite line in the margin of the gum. It seems to be a diffuse discoloration of the tissue with marked swelling and loosening from the teeth. These findings are sufficient to lead one to ask about the patient's occupation, water supply, any possible habitual use of products wrapped in tinfoil (which is usually lead foil), any use of cosmetics,[9] snuff,[10] etc.

The principal change which takes place in the blood is a toxic condition which causes a pathologic regeneration of red cells. This is indicated by the presence of many cells with basophilic stippling, many of which are polychromatophilic. These cases commonly are accompanied by anemia, nervousness and weakness, and these facts should be the modifying factors in carrying out dental procedures. Any necessary work may be done in the mouth. The removal of septic foci relieves the blood-forming apparatus of their suppressing effect. The conditions usually clear up easily after the course of lead has been removed and the body well purged.

The relative importance of this group of diseases is perhaps best shown by figures from the Government, Department of Commerce.[11] The mortality statistics show how many deaths are recorded from these various diseases. These, of course, do not include a great many cases of individuals alive and suffering with these diseases and who are likely to walk into the dental office at any time for attention. The death rate in cases of pernicious anemia, leukemia, chronic lead poisoning, purpural hem-

9. Barron, M., and Habein, H. C.: Lead Poisoning, with Special Reference to Poisoning from Lead Cosmetics, Am. J. Med. Sc., 162: 833-862 (Dec.) 1921.

10. Uttal, J.: Lead Poisoning from Snuff; Report of Three Cases, J.A.M.A., 90: 288-290 (Jan. 28) 1928.

11. Department of Commerce, Bureau of the Census. Mortality Statistics for 1924. U. S. Gov't. Printing Office. Washington, 1927. Mortality Statistics for 1925. Published 1927.

orrhage and scurvy is approximately ten persons per hundred thousand.

Blood findings in cases of cancer may reveal the true condition in many cases in which the cause of the illness is difficult to diagnose. Changes take place in the neutrophils and monocytes which are quite characteristic for the condition. As the blood findings are more marked and characteristic for growths situated lower down the alimentary system, blood smears in cases of cancer of the buccal cavity are not to be relied on.

Another fact which recently was called to the attention of the dental profession and which can be emphasized again is the value to those who do a great deal of work with roentgen rays of having periodic examinations of the blood. Roentgen rays tend to suppress the activities of the bone marrow and this may be shown as a moderate anemia accompanied by leukopenia or a lowered white cell count. That the common dental roentgen ray units either do not provide adequate protection, or that secondary radiation is absorbed to a great extent by the operator in continued small doses, is easily determined by carrying a coin fastened to a film with adhesive tape, for a week or two, and then developing the film. The extent of radiation absorbed by the dental roentgenographer doing an average amount of work is a great deal more than the average medical technician gets, because of greater precautions taken by the latter.

The search for a better understanding of the problem of focal infection has found a great many physicians, pathologists and dentists at work on the effects of infection from localized areas of the body on the blood. With the presence of infection in the dental area, it becomes important to decide whether such infection is of local or of general importance, and whether interference should be instituted as a prophylactic measure or as a curative one. It is here that the differences of opinion arise regarding the management of the pulpless tooth. The ultimate solution to this problem is prevention, but the time is probably far distant when this Utopia will be reached in spite of the splendid work that is being done in the field of preventive dentistry.

The blood may be likened to a reservoir of nutritive materials which have been prepared by the digestive system and absorbed from it, of oxygen which has been gathered at the respiratory surfaces of the lungs and of decomposition products produced by and absorbed from the tissues. As it flows through the delicate capillaries, portions of its soluble

MORTALITY STATISTICS, BUREAU OF THE CENSUS, DEPARTMENT OF COMMERCE.

Cause of Death	Number			Rate per 100,000 Estimated Population		
	1924	1925	1926	1924	1925	1926
Pernicious Anemia	5,487	5,949	5,878	5.5	5.8	5.7
Leukemia	1,589	1,801		1.6	1.7	
Chronic lead poisoning	142	142		0.1	0.1	
Purpural hemorrhage	1,517	1,466		1.5	1.4	
Hemorrhage without specified cause	165	132		0.2	0.1	
Scurvy	45	58		Less than 0.1	0.1	
Cancer of the buccal cavity	3,130	3,242		3.2	3.2	

nutritive constituents, including oxygen, are given to the tissues, by which they are utilized for growth, repair and functional activity. At the same time, the tissues yield to the blood a series of decomposition products resulting from their activity.

It follows that anything which will affect the blood will affect the tissues and, conversely, anything that affects the tissues will affect the blood. The theory of focal infection gives prominence to the transmission by the blood stream of micro-organisms and their toxins from localized areas to remote parts of the body. It is because of this that the blood has been extensively studied. I wish to quote a few lines from a previous paper[12] regarding the manner in which the blood-forming apparatus may respond to demands made on it.

Blood cells are primarily tissue cells. They originate in the tissues and function in the tissues using the blood stream merely as a medium of transportation. The blood picture as found in the peripheral blood stream is the resultant expression of the combined activities of the hematopoietic system; in other words, what we find in the blood stream is merely the indication of what is going on in the blood-forming tissues.

The cells which circulate in normal blood are adult forms of their type, and are found in numbers which stay within certain limits for each type. To what extent this normal formula remains uniform depends on the nicety of balance in formation of cells by the blood forming tissues, and subsequently their introduction and removal from the circulation. Normally, this cycle is completed at a rate which enables this balance to be maintained with a fairly constant degree of stability. Stimulation, as the result of increased functional demand to any part of these systems, can increase or suppress their activities, this depending on the intensity of the stimulus. This may result in a change in the absolute number of cells, alter the usual proportion of different types of cell or produce changes in their structure. If the exciting agent is of such a degree as to stimulate these activities, the result will be an added production or an increase in the absolute number of cells, or will increase the relative proportion of one or more types of cells. The same stimulant of different intensity might suppress the activities causing a decrease in the absolute number of cells or a decrease in one or more types of cells to alter the relative proportion. Carried to an extreme degree, the outcome can be exhaustion of the blood forming organs, at which point they are not capable of functioning sufficiently to support life. Coincident with the above mentioned changes, the cells themselves may exhibit evidence of (1) increased functional activity (increase in cytoplasm, appearance of vacuoles, increase in nuclear lobulation); (2) normal regeneration (immaturity); (3) pathologic regeneration (cell structure indicating misdirected development); (4) degeneration (coalescing of the chromation in the nucleus, causing a blurring in the nuclear pattern, fusion of nuclear segments, pyknosis of the nucleus, development of granule-free spaces, alteration of size, shape, number, staining reaction and distribution of granules; alteration in size and shape of cells, change of position of the nucleus in the cytoplasm, and fragmentation of cells).

Many reports of the changes which take place in the blood stream in cases of dental infection have been published. Practically all of these are concerned with the changes in the numbers and proportion of the cells. Few of them make any note of the changes in the structure of the cells. It is from this angle that my studies have been undertaken. No cell which may be regarded as diagnostic for oral infection was found in my studies. Several recent papers, by other workers, have confirmed this observation. In a previous paper,[13] blood studies of healthy young men having various types of dental infection

12. Epstein, I. A.: Qualitative and Quantitative Consideration of the Cells in Normal Blood: Part 1, J.A.D.A., 15:1055 (June) 1928.

13. Epstein, I. A.: Qualitative and Quantitative Consideration of the Blood Cells in Cases with Dental Infection, J.A.D.A., 16: 1064 (June) 1929.

were compared with those of a similar group free from dental infection. This comparison was made with the aid of the differential form for the qualitative analysis of the leukocytes. The difference shown by the comparison of the two groups was a definite group tendency for certain changes in the cases with dental disturbances to be common, but they were found to lie within the normal limits of variation as found in the group free from such dental infection. This study showed that dental infection *per se* does produce a mild degree of anemia in healthy adults. There was an average red cell count and hemoglobin value, which was lower in the group with dental infection. One case showed a moderate amount of anisocytosis, hypochromasia, and some polychromatophilia, morphologic evidence of a mild secondary anemia. The leukocyte counts showed the value for the group with dental infection to be more in the lower and higher levels, although the averages of the leukocyte counts of the two groups were practically identical. The differential counts showed little variation between the two groups. The qualitative study of the leukocytes showed an increase in the number of band, toxic and fragile neutrophils, leukocytoid lymphocytes and young, toxic and lobulated monocytes in the presence of undisturbed major cell proportions. As with the red cell and hemoglobin values, the extent of difference in the majority of cases lies within the normal range of variation.

While there is a definite group tendency for these changes to occur, diagnostic importance can be ascribed to them only when they exceed the limits of normal. They cannot be considered pathognomonic for dental infection without consideration of the effect of other pathologic conditions on the hematopoietic system at the same time. These changes are those which are found in all infections in the group of acute and chronic diseases, and the extent of the alterations depends on the severity of the infection at the particular time. They may be interpreted when found as an indication that there is a toxic process in effect and the degree of its severity; or they may be interpreted as an index of the patient's ability to react to injury from infection. Several papers which have recently been published by others have confirmed such parts of the foregoing as the authors have studied. Weber[14] found a shift to the left in his studies. Rygge[15] also reports a shift to the left which was not evident in all cases. His results are in accord with those of Heidemann's studies in cases showing aural infection. Matis,[16] in his studies on the toxic granulation of the neutrophil leukocytes in infections, states that it is not found in all cases, and that much stress can be placed on the value in diagnosis of this type of granulation as denoting the presence of a toxic process, but that the absence of it does not necessarily mean the freedom from infection.

The work of others, which I am now in the midst of checking, indicates a typical leukocytosis with an increase in the polymorphonuclear neutrophils in cases of acute dental infection and a

14. Weber, R.: Das Blutbid bei entzundlichen Erkrankungen in der Mundhohle, Deutsch. Monatschr. f. Zahnheilk.

15. Rygee, Johan: Blood Studies in Cases of Periodontal Inflammation, Ztschr. f. Stomatol., 26:584, 1928; abstr. Dent. Cosmos, 70: 1035 (Oct.) 1928.

16. Matis, Elias: Uber die toxischen granulationen der neutrophilen Leukozyten und ihre praktische Verwendbarkeit, Folia haematol. 36, Nos. 3-4 (July) 1928.

leukopenia with a relative lymphocytosis accompanied by anemia in the chronic cases.

As above, the studies now in progress are being made with the aid of the differential form for qualitative analysis of the leukocytes.

SUMMARY

Dental students should be taught to observe alterations in the mouth in cases of systemic disease by being given the opportunity to see and study cases in hospitals which are associated, for teaching purposes, with dental colleges. By recognizing the mouth manifestations of systemic diseases, dentists can broaden the scope of dentistry as a health service.

The dentist has the right, and is distinctly obligated, to order examination of the blood in cases in which he believes blood findings to be of value, just as he makes use of other diagnostic aids at his command.

Blood examination should be made:

1. When there are spontaneous hemorrhages from the gums and mucous membranes without obvious and direct irritation or injury.

2. In Vincent's infection which prolonged thorough treatment does not clear up.

3. In cases in which there are numerous petechial hemorrhages in the gums, mucous membranes or tongue.

4. In postoperative hemorrhage which cannot be controlled by local therapeutic measures.

5. In cases in which the history shows a marked tendency to bleed from minor causes.

6. For individuals with marked pallor of the mucous membranes.

7. In sore mouth or tongue which persists without demonstrable local irritation.

8. In cases showing metallic sulphid deposits in the gingivae.

9. In cases in which it may assist in determining the status of infectious processes.

10. For roentgen-ray technicians periodically.

357 Lowry Building.

FUNDAMENTALS TO BE CONSIDERED IN RESTORING NORMAL OCCLUSION WITH CROWNS AND BRIDGEWORK*

By C. K. BIRD, D.D.S., St. Paul, Minn.

VOLUMES have been written on the technical side of bridgework, the types of attachments and pontics, the various methods of replacement, the materials used, and as to whether the restoration is to be fixed or removable. All these subjects have been thoroughly considered and discussed time and again.

No branch of restorative dentistry can boast of a greater variety of methods. Still, we have evidence that this bridge or that restoration fails to give efficient service, while similar replacements in other mouths do outlive their expectancy.

The extraction of diseased teeth has resulted in an enormously increased demand for some type of partial denture restoration. Are we meeting this de-

*Read before the First District Dental Society of New York, Jan. 7, 1929.

mand, with the main thought of considering the welfare of the mouth as a whole, or are we merely filling spaces?

Since the beginning of time, the arch form has been recognized by engineers as a carrier of loads; and no arch is considered better than its poorest unit. The normal masticating machine consists of two opposing arches, a compound circular, shearing and grinding mechanism, with evenly distributed forces, composed of individual units, but functioning when ideal as one unit.

It is reasonable to assume that such a carefully designed mechanism must function on some fundamental principle. If many of our restorations do fail under certain conditions, it becomes apparent that, back of methods and workmanship, which we all agree are necessary, we must have overlooked these first principles of restorative dentistry. In bridgework, we are called on to restore the lost function of teeth, and if we fail to do this, it must be because we fail to recognize the fundamental principles of functional occlusion.

Fig. 1.—The occlusal view of both arches. The continuity of arch form is nearly perfect, with all teeth present.

The industrial world builds and assembles certain parts and materials with a desire to produce a perfect machine as an end-result. The fundamental principle involved, on which the machine is to function, is known, or fairly well understood, in the mind of the producer before any operation is started. In this respect, the practice of dentistry has been unlike any phase of industry. We have directed our attention entirely to patching and fixing parts of a machine, the underlying principle of which we little understood or considered.

Patient and operator alike have devoted much time and energy to methods of replacing and restoring the various units of an apparatus, later to learn that the repair work was a failure. We then condemned the method used, and sought other expediencies, with a like result. Let me illustrate by calling attention to the fact that many capable men have condemned fixed bridgework as a failure simply because of fixation, only to find, that the lack of fixation, as in the removable restoration, did not always assure success.

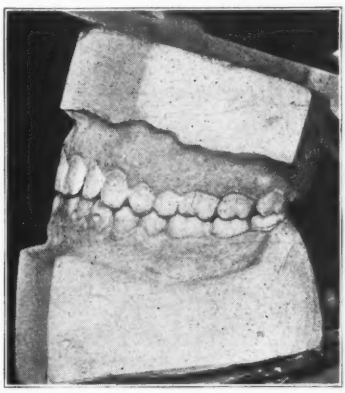

Fig. 2.—The same case (Fig. 1) in central occlusion. This is the relationship usually considered when the word occlusion is mentioned. Here also is an example of a norm in overbite and overjet.

At the present stage of our dental evolution, we find an ever increasing interest in a study of the mouth as a whole, a consideration of all the teeth, their relation to each other in all positions of occlusion, and their influence, when in normal or abnormal relation, on the physiologic action of adjacent organs.

My object is to present a few facts relative to functional relationship of mandible to maxilla. There is an old

Fig. 3.—Right lateral range, following a movement of the mandible to the right. The amount of occlusal contact in this position is to be noted.

axiom which states, "We see that which we are taught to see," and it most certainly applies to our profession. The great majority of patients with whom we come in contact are those whose dental condition necessarily demands our service. Seldom do we see the ideal, highly efficient, balanced case, as that case rarely comes to the attention, having little use for our service in crowns and bridgework. This infrequent appearance probably accounts for the fact that its working principle is so little understood.

"Anatomists," as R. W. Burch of Florida writes, "describe how a man walks, how he runs, and how he performs any of the mechanical movements common to the species. He does not say that they all walk alike, or that they all have the same gait, but he describes in

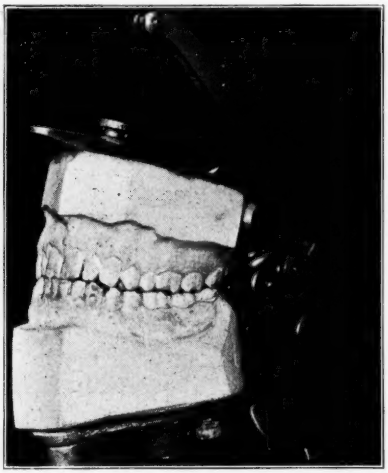

Fig. 4.—View of the opposite side in this same position. The balancing occlusal contact divides the stress of mastication equally on each side.

detail the sequence of movements, which are fundamental in all cases. Now if you were called upon to replace a lost foot, would you prefer to find out how he walks as a cripple, or would you attempt to replace this lost member, so that he could go through the natural movements, as anatomists describe them?"

Confining our attention in the past, to the detail of methods and unit technic,

regardless of how necessary, has had a tendency to narrow our vision and detract from a study of the whole masticating machine, with the result that we have filled cavities and spaces to the existing condition of central occlusion. We have perpetuated malocclusion and other deformities, giving no thought as to the forces exerted in the various chewing ranges or the anatomic relationship of all parts.

Let us examine briefly a nearly ideal case, considering in part its functioning ranges, in order that we may better recognize malocclusion or dental deformity. (Figs. 1-7.)

Fig. 5.—View of the left lateral range.

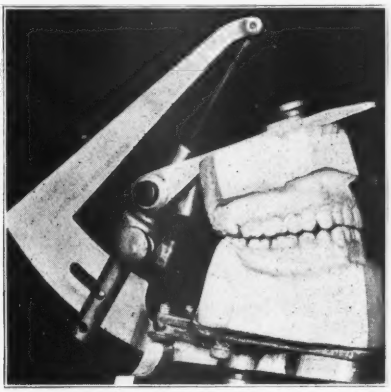

Fig. 6.—Opposite side during this range. The amount of occlusal contact is to be noted, each cusp traveling through its corresponding groove with balanced efficiency.

Through all of the working ranges, there is a uniform and maximum contact, each tooth, according to its design and position in the arch, receiving its proper proportion of stress. This we term the mechanical balance of occlusion. The dentist, in attempting the restoration of any tooth in this arch, assumes the responsibility of reproducing this coordinating unit balance, and in the degree in which he fails to recognize the difference between balanced occlusion and malocclusion will he upset the equilibrium of this ideal arrangement, as observation shows that a small variation from the normal in the reproduction of dental units will in time cause a decided change in the whole mechanism.

The occlusion acts as a stop in the upward swing of the mandible, an important function of teeth which is often overlooked. If the vertical dimension of the teeth is lost, either wholly or in part, the mandible will continue in this upward movement, attempting to maintain occlusal contact in this shortened dimension. This in turn drags all the structures attached to it out of normal position, and naturally interferes with their function.

Let us picture the changes arising from lack of care as time passes which may take place in this ideal occlusion; contacts and occlusion become worn, cavities may appear and eventually some teeth may be lost, breaking the continu-

ity and changing the shape of this arch, which results in the tipping and drifting of adjacent and opposing teeth, throwing an overload on certain units and creating the pathologic condition of supporting structures with which we are all familiar. We now have quite a different picture.

Figures 8-12 show a condition which we term malocclusion or traumatic occlusion. In either lateral range, a few teeth, many of them single rooted, receive all the stress that should be distributed proportionately and collectively. These lateral range, working or functioning stresses, when unbalanced, are the deforming forces which throw an overload on a few abutments, driving them farther out of line and destroying their attachment.

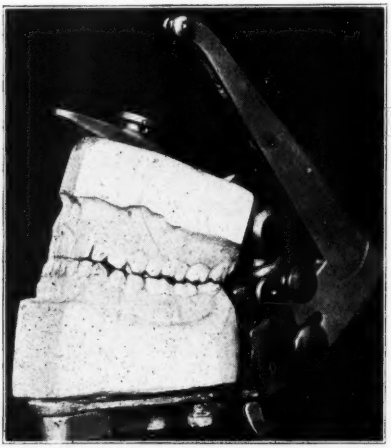

Fig. 7.—View of same casts in the forward range, showing the end-to-end relationship of the anterior teeth, with the cusps of the posterior in balanced contact, which determines that a normal overbite exists.

The shearing, grinding and crushing action of the ideal occlusion is lacking, and we have merely the straight "open and close," bite of a forced central occlusion, with little or no masticating efficiency. To merely fill these spaces with bridgework, perpetuating this deformity instead of restoring the case to its former condition of normal occlusion, is to invite failure, because of the lack of balance in the various ranges, and the incorrect application of stress. This is true whether the bridge is fixed or removable or any other type of partial denture restoration is used.

These failures have too often been ascribed to the type of abutments and attachments, when, as a matter of fact, they were usually the result of a lack of understanding of the action of the masticating mechanism as a whole.

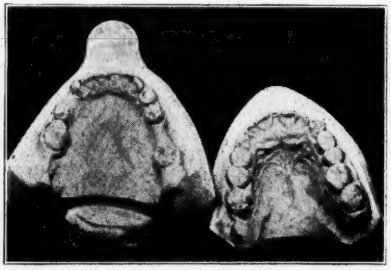

Fig. 8.—Occlusal view. The broken and irregular arch form and also the malposition of certain teeth are to be noted.

Nature constructed these opposing arches and their supporting structures to carry heavy loads, in some individuals almost continuously. The hookup of the muscles involved is one of the most powerful in the human body, but so beautifully synchronized that the individual is not conscious of the power developed. When the arch form is balanced and unbroken, the relationship of the jaws and the teeth remains unchanged; when the teeth are lost or broken down, with this powerful muscle-pull still present, we

witness, with few exceptions, these remaining teeth driven through bone structure to malpositions, an abnormal relationship of mandible to maxilla being eventually produced. Whether these spaces are filled or not, if malposition of teeth and jaws is maintained, the retrogressive process continues. Let us examine a case in which extensive bridgework was constructed to the existing deformed jaw relationship. (Figs. 14-15.)

Bridgework, where necessary, should be used as a means of restoring occlusion to normal rather than merely to fill spaces, and the fact that bridgework is necessary is generally an indication as to the mouth condition.

The foregoing is sufficient evidence that dental deformities should be corrected if possible, and in those cases in which a closed bite condition is a part of the deformity, it is necessary to open the bite to its normal dimension as part of the correction. This is a higher conception of the value and function of bridgework.

At the conclusion of diagnosis of any reconstruction case, when effect and cause of the deformity have been noted and determined, and before any operation is begun, the dentist should be able to visualize the final result. He should have a mental picture of the completed case in all functional ranges; just as the architect must have a vision of this building before ever a brick or stone is ordered.

Figures 16-25 illustrate how bridgework may be used to restore a deformed occlusion to normal. Slides of several clinical cases will be shown.

For the past ten years, I have adhered strictly to this idea of reconstruction in an effort to make better and more efficient masticating machines of these dental wrecks; and I can assure you that the element of guesswork in this method has at least been reduced to a minor quantity.

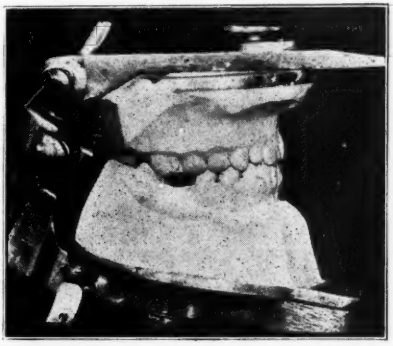

Fig. 9.—The same case (Fig. 8) mounted in central occlusion. The abnormal overbite, also the elongation of those teeth receiving no stress and the intrusion of others receiving excessive stress are to be noted.

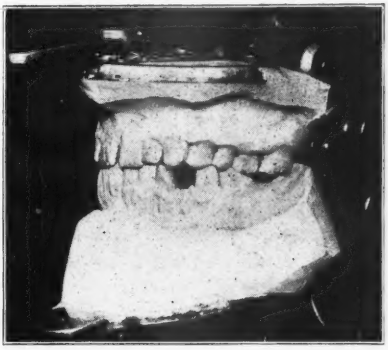

Fig. 10.—Opposite side of the same mounting (Fig. 9). The elongated upper molar is in contact with the lower ridge.

We have discussed the fundamentals underlying reconstruction, realizing that, until they are understood, the detail is of little value.

SUMMARY

We must establish balanced occlusion, thereby obtaining an equal distribution

of the applied forces, as well as a correct relationship of the opposing jaws.

The anatomic and physiologic balance

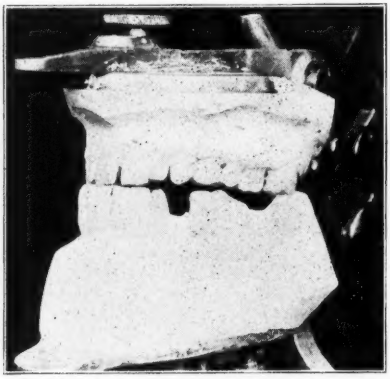

Fig. 11.—View of the case (Figs. 9-10) in a functioning range showing how and where unbalanced forces are applied. There is no occlusal contact in the molar region, which results in excessive stress on single rooted teeth, not intended by nature to receive this load.

obtained in any reconstruction depends entirely on the exactness of mechanical balance. This latter is the stimulus

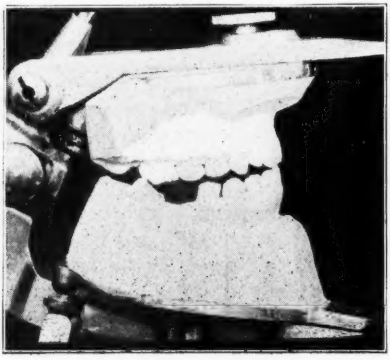

Fig. 12.—Opposite view of the same lateral range (Fig. 11). One cusp in the molar region receives all the burden in this range.

which is responsible for the necessary muscle and bone development, and which changes bone and muscle growth to new form and balance.

The type of deformity; the lack of

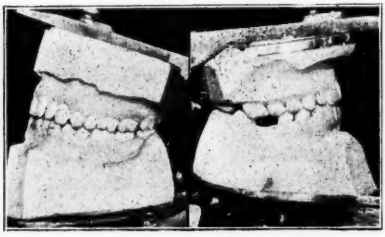

Fig. 13.—Comparison of ideal and mutilated cases in central occlusion.

function and development; jaw and tooth relationship, the amount of wear and closure; the impaired act of swallowing, with its resulting lack of drainage and negative pressure—these are a few of the factors to consider in restoring function of the oral cavity and associated parts.

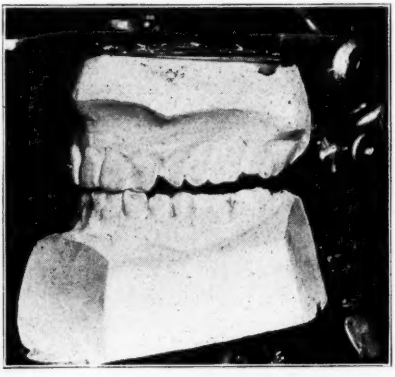

Fig. 14.—Casts of a case mounted to reproduce the actual occlusal discrepancy in functioning ranges, as was found in the mouth. This full mouth reconstruction, consisting mostly of bridgework, shows that the operator failed to make the restorations function except in central occlusion.

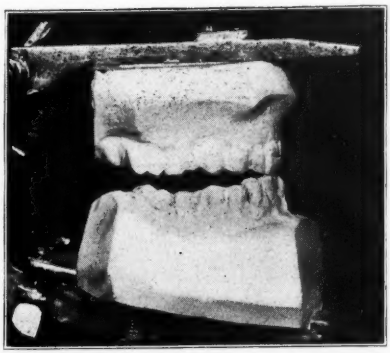

Fig. 15.—Opposite side of the same case (Fig. 14) in a protrusive relationship. The occlusal discrepancy in the molar region is usually an index to the amount the bite should be opened. The principle of balance was overlooked and the spaces where teeth were lost were filled to the condition as presented. The anterior teeth receive excessive stress in all the functional ranges and are generally abraded or driven to malpositions.

Unbalanced occlusion is generally the prime cause of failure in any type of reconstruction. The underlying or basic principle in all reconstruction must be the fundamental principle of occlusion. We must have a means of recognizing unbalance in the area that we are called on to treat. This means correct diagnosis, which is made possible by a thorough knowledge of what constitutes the ideal or norm in nature.

Fig. 16.—Left: Case as presented, in a man, aged 50. There is a marked overbite. The upper second bicuspids were lost at early age, and never replaced, adjacent teeth drifting mesially and lingually, constricting the upper arch and retarding the development of the lower. Center: Thirty days later, showing relationship as reconstruction was completed. The anterior opening is to be noted. Right: Six months later. The lower teeth and process have straightened, closing this anterior space, after the deforming force was removed.

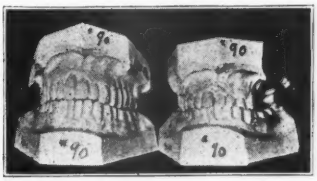

Fig. 17.—Casts of a case before and after reconstruction. This patient gave a history of having had an end-to-end bite, but owing to loss of teeth and excessive wear, an acquired prognathic condition was developed as the bite closed. The bite was opened with fixed reconstruction, as shown.

Experience teaches that a scientific diagnosis can best be made from a study of casts correctly mounted on a spherical instrument, with a fixed center, on which the exact relationship of mandible to

Fig. 18.—Casts of a badly worn end-to-end case, before and after reconstruction, in a patient, aged 50. The anterior space has since closed to a normal overbite.

maxilla in all movements can be reproduced.

The accuracy of this diagnosis depends much on a knowledge of anatomy, physiology and the spherical theory of occlusion; these are all fundamentals.

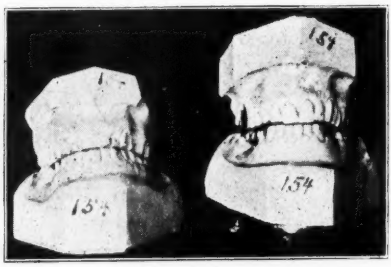

Fig. 19.—Another case of similar type (Fig. 18) before and after reconstruction, in a patient, aged 45.

In the past, too much attention has been directed to an immediate and temporary answer to our problem and too little attention to the problem itself. We have become confused with many methods of preparation and attachment, forgetting that fundamental principles are natural laws, the simplest of which is to reproduce and maintain as our pattern the highest expression of nature, the ideal.

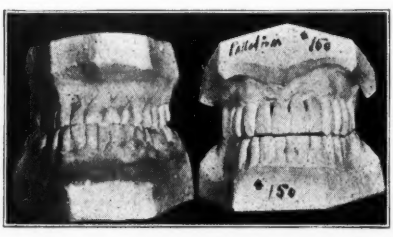

Fig. 20.—Casts from the mouth of a patient, aged 43, presenting an acquired prognathic condition due to early loss of upper cuspids, and a chronic pathologic condition, which necessitated the removal of several teeth. The case was reconstructed with bridgework, and two years later finds the supporting tissues firm and healthy, with the facial appearance greatly improved.

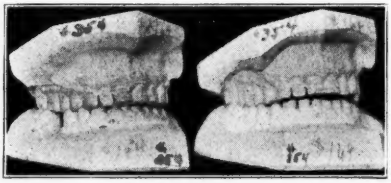

Fig. 21.—Casts of mouth of patient, aged 30. The lower first molars were lost and there was excessive wear on the anterior teeth, with traumatic pathologic condition present. The posterior occlusion was restored to balance, with bridgework, taking the load off these single rooted teeth. The pathologic process has since disappeared, and the anterior space has closed noticeably in six months.

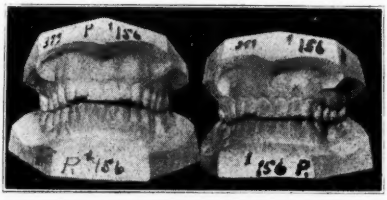

Fig. 22.—Casts of mouth of patient, aged 38, presenting a somewhat similar condition, due to the same cause: loss of the lower first molars. Again, we find excessive wear on the anterior teeth. The case is shown before and after reconstruction.

Fig. 23.—Casts of the mouth of a patient, aged 45. The lower left second molar was extracted years ago and not replaced. Four upper bicuspids were recently lost and later replaced to a badly worn and closed occlusion. (Case before and after reconstruction.)

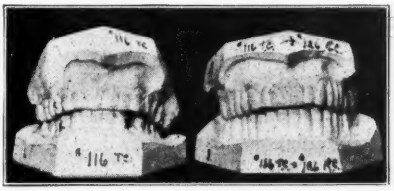

Fig. 24.—Casts of mouth of patient, aged 45, presenting a full mouth reconstruction, placed five years ago to a closed relationship. The abutments used were tipped and out of arch line. Treatment: pontics removed and abutments brought into normal arch form, by the use of splints and orthodontic means, before reconstruction was attempted. The difference in appearance and efficiency of these two cases of bridgework is to be noted.

Fig. 25.—Casts of mouth of patient, aged 36. This mouth exhibits the work of many operators, some of which is the author's, built at a time when only the restoration of the individual unit was considered. Owing to the fact that a certain systemic condition existed which was attributed to several pulpless teeth and a chronic pathologic process, these teeth were extracted and the case was reconstructed to a balance with bridgework, as shown.

PHYSICAL PROPERTIES OF DENTAL MATERIALS (SOME LABORATORY EXPERIMENTS FOR THE DENTAL SCHOOL)

By WILMER SOUDER,† Ph.D., Washington, D. C.

INTRODUCTION

FROM the program of this meeting, I observed that the sessions are to be concerned primarily with the educational phases of dentistry. In the preparation of this paper, it will, therefore, be appropriate to give a large amount of attention to work that may fit into the educational program of the dental school. Parts or all of the suggestions outlined in this paper are unquestionably being used by the more progressive schools, but a collected review will be of value to all of us.

INTEREST IN DENTAL RESEARCH

The unusual interest manifested in dental research during the last six years is sufficient proof of the importance attached to the subject. During the month of February, visitors at the National Bureau of Standards interested in dental problems numbered forty-six, an average of two each working day. These visitors were not of the "sight-seeing" variety, but made the trip out to the Bureau for the purpose of discussing some particular phase of a dental problem.

*Read at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 25, 1929.

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

†Principal Scientist-Physicist, National Bureau of Standards.

COOPERATION WITH AMERICAN DENTAL ASSOCIATION

The American Dental Association has, at this date, one man on full time (N. O. Taylor) and one man on half time (H. S. Berger) stationed at the Bureau of Standards and engaged in the cooperative research which was started about one year ago.

PROBLEM IN IMPRESSION TAKING AS AN EXAMPLE

The problems of engineering, physics and metallurgy encountered in dentistry are not all solved at this late date. Suppose we take a plunge into the pool, over our heads, and see what we may bring up. Here is one: impression taking. This may seem too simple for serious consideration, but, at this very date, Association and Bureau scientists are attacking it in a systematic manner. We have started with a flat surface or plate about 3 inches square and have placed two pins, slightly tapered, about 2 inches apart in this plate. (Fig. 1.) These pins represent abutment teeth or they represent

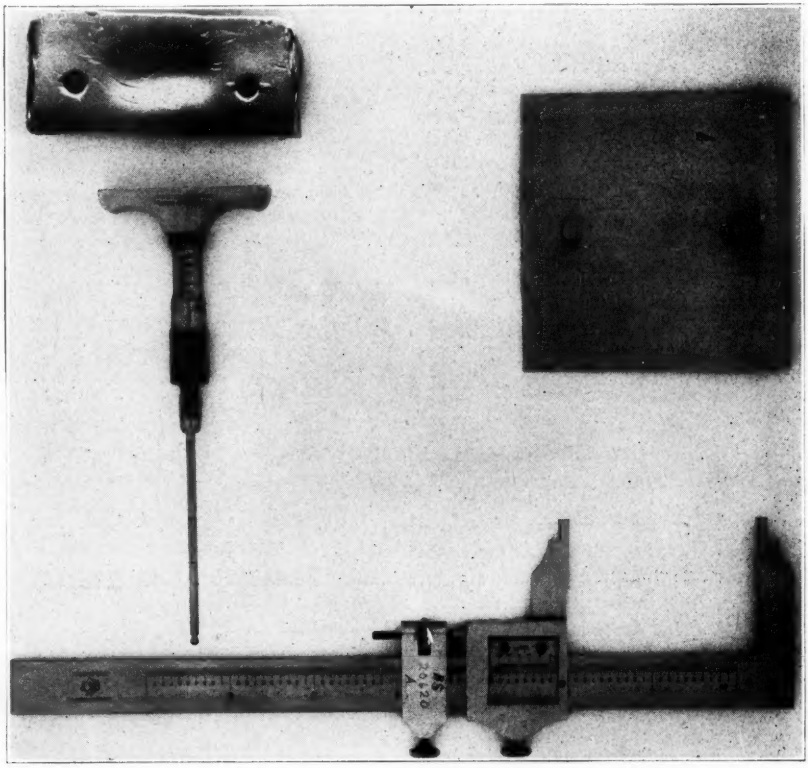

Fig. 1.—Plate, impression and micrometers for measuring accuracy of impressions. The impression made on the flat plate is concave.

sections of the ridge, this depending on whether we are interested in partial or full dentures. Never mind whether the partial denture is to be a fixed or removable appliance, and do not criticize the width or distance between the abutments.

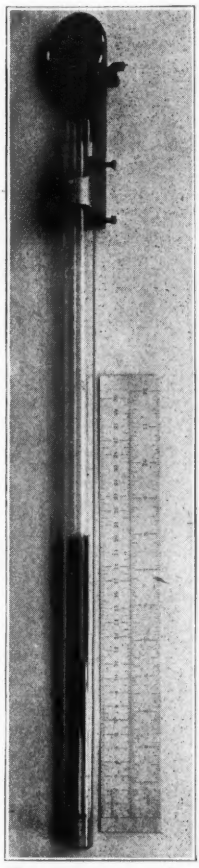

Fig. 2.—Fused quartz tube expansion equipment with indicator attached. The dark object in the tube is the specimen in position.

We are making tests for accuracy of impression, and by using the longer distances, we are able to display more effectively the defects of a technic. Seven Washington dentists are cooperating in this problem. We are striving for flat surfaces on the poured model, for an exact distance between pins, and for the conditions which will enable a technician to make a partial or a full denture as he wants it, free of distortions. I recommend this simple equipment of flat plate with two taper pins, and the vernier micrometer to verify results, as one of the exercises for your dental students. Prominent men in the Association who are assisting us in this work are discovering some most interesting facts with these simple tools. I believe that we have one answer to the difficulties met, but further verifications are required before releasing it for publication. I anticipate a more complete report on this subject by the research associate of the Association at the Washington meeting next October.

TESTS OF AMALGAMS AND AMALGAMATORS

The next issue of THE JOURNAL (April, 1929) will contain two reports on dental amalgam and will show a very surprising situation in regard to the use of mechanical amalgamators and a further surprise in the properties of amalgams offered the profession in 1928. You are now at a critical stage in this program. Some manufacturers whose product was shown to be defective have taken the situation seriously, have asked for help in correcting their alloy, have purchased testing equipment, and, I dare say, are now supplying satisfactory material. Others have shown no constructive interest but have rather shown a spirit of apathy toward the work. Unless you support the manufacturers who are sincerely interested in producing superior materials, and show your students how to verify these properties of superiority, the amalgam sales will revert to the anti-

quated personal endorsement method now so popular in cigaret propaganda. The articles in the April JOURNAL to which I have referred, in connection with two additional articles[1] on this subject, will enable you to equip your laboratory for this type of testing. The difficulties which you anticipate in using the interferometer will disappear after you have received a few hours' assistance from the professor of optics in the liberal arts department of your university. In many instances, you will find most of the equipment available in the physics, chemistry or metallurgy departments of the

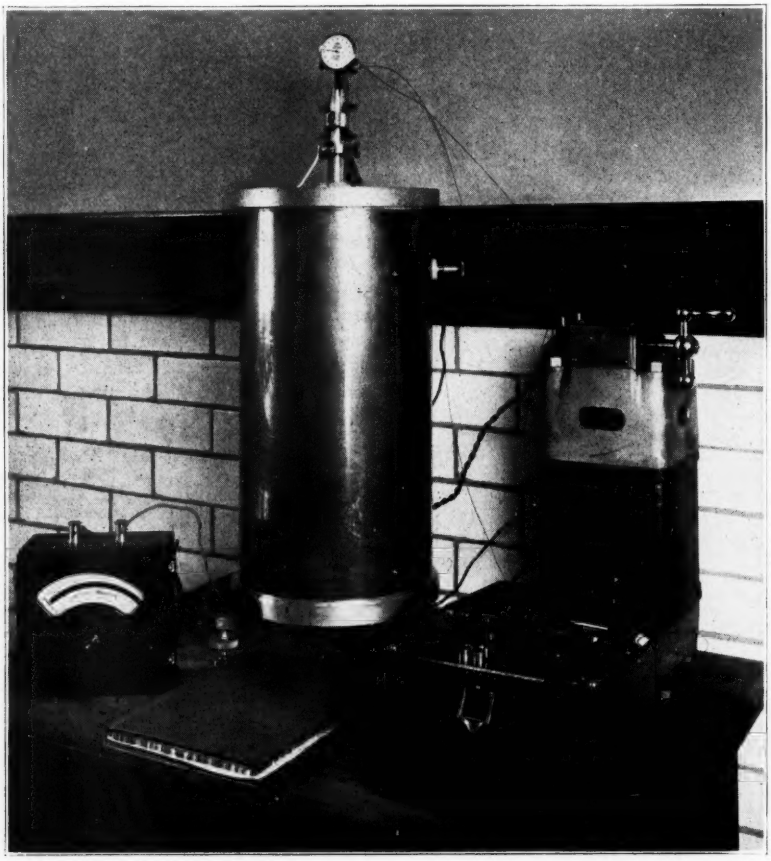

Fig. 3.—Expansion tube shown in Figure 2 placed in an electrical heating furnace ready for use in measuring thermal expansion.

1. Bureau of Standards Technologic Paper No. 157. (Price 10c, Superintendent of Documents); reprinted, Dent. Cosmos, 62: 305 (March) 1920; J. Dent. Res., 7:186 (June) 1927.

university. This is true, to my knowledge, at the following schools and doubtless at many other schools: the state universities of Illinois, Michigan, Iowa and Tennessee; the Massachusetts Institute of Technology and Columbia University.

Our cooperating dentists in Washington are taking time from their practice to come to the Bureau weekly and make specimens from different brands of alloys and by different technics. They are enthusiastic in this work, and gladly give their time and sustain the loss of practice incident to this time spent at the Bureau. They were not given opportunity for this class of laboratory work at the dental college during their scholastic training. These men will be in a position to give the profession some specific information at the clinic which they are preparing for the annual meeting mentioned previously. With an appropriation of less than $1,000 and with the cooperation of the optics and engineering departments of your university, or with an appropriation of less than $100

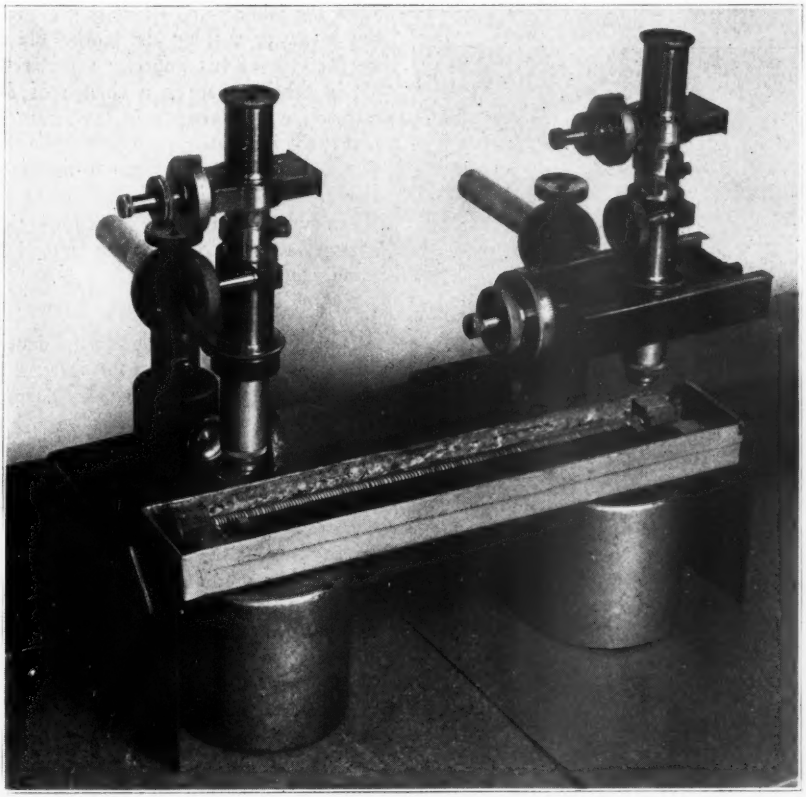

Fig. 4.—Comparator arranged for measuring thermal expansion of a dental wax.

and under the supervision of those departments in the schools mentioned above, you can do the same type of work the American Dental Association is now carrying out at the Bureau.

UNCERTAINTIES IN OPERATIONS

The use of alloy golds in restorations and the use of accessory materials in

Fig. 5.—Testing machine having a capacity of 600 pounds.

producing these restorations introduce a number of complications in the process. The man who mallets foil into a cavity where foil is indicated can make every move in the operation with the feeling of utmost confidence that it is the correct and most efficient move. He knows his restoration is to size, is adapted to the cavity walls and will give service defying all causes of failure common to other types of restorations.

For the alloy gold restoration, cast or wrought, he has not this assurance. Possible and probable inaccuracies of dimensions of finished appliance haunt him from the minute that he finishes cutting the cavity or shaping the tooth. He is not certain of his impression material. Undoubtedly, there is a change of dimension with a change in temperature, and if the impression is correct while the plastic material is hot, can it maintain this exactness as it cools? I doubt it. Then what is the magnitude of this change and what methods can be used to minimize it?

THERMAL EXPANSION EQUIPMENT

This makes it desirable for the dental school to provide means for measuring thermal expansion. The physics department can again render this service, but it seems to be of sufficient importance to be regarded as a necessity for the dental school, and I therefore suggest the installation of expansion equipment and determinations of thermal expansion of one or more of the dental waxes, investments or impression compounds, by students as part of their laboratory requirements. Two types of equipment are shown in Figures 2, 3 and 4. The thermal expansion equipment shown in Figures 2 and 3 consists of a fused quartz tube about 50 cm. long and 2 cm. in diameter closed at one end. The specimen to be tested should be about 20 cm. long and is placed in the tube. On top of the specimen is placed a fused quartz rod or plunger sufficiently long to reach the open end of the tube. An indicator gage is fastened to the top of the tube and registers the relative motion between the tube containing the specimen and the

rod resting on the specimen. The bottom of the tube (inside) and rod are ground concave, and the ends of the specimen to be tested should be made convex. Heating is effected by placing the tube and sample in a water or oil bath or in an electrical furnace extending well above the top of the specimen. A thermocouple placed inside the tube near the sample indicates the temperature. The average coefficient of expansion of fused quartz (0.0000005 to each degree C.) should be added to the expansivity coefficients secured from this equipment. This equipment will give results accurate to better than 2 per cent in the value of the coefficient for ordinary materials.[2] This tube and plunger type of expansion equipment is not satisfactory for use on plastic materials, at least not in the plastic range, unless provision is made to protect the specimen from the weight of the plunger and from its own weight if tested in a vertical position, as shown in Figure 3.

Figure 4 shows the old and very satisfactory comparator consisting of two micrometer microscopes fastened to a rigid base of known expansivity. The specimen is placed in the water bath container below the microscopes. Reference lines are cut on the polished plates near either end of the specimen. Heating is effected by electrical resistance windings along either side of the specimen. The water must be stirred constantly during any heating or cooling of the bath. Changes in length of specimens are recorded from the micrometer readings of the microscopes. This equipment is more satisfactory for use on the plastic specimen than that shown in Figures 2 and 3. The accuracy is not so great, but is sufficient for rating waxes and impression materials.

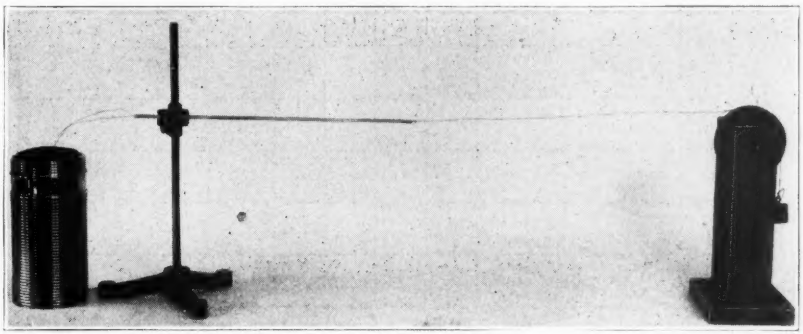

Fig. 6.—Arrangement of wires for making a fusion temperature determination. The wires are passed through an electrical heating furnace when the test is started.

The equipment in Figures 2 and 3 is suitable for the more rigid materials, such as set plasters, investments and artificial stones. Students who have measured these properties of dental supplies will at once realize their significance and their uniformity of behavior, and will often regard and utilize these constants as a possible source for improvement in

2. A complete description together with illustrative data is to be found in Bureau of Standards Research Paper No. 29; price, 10 cents, Supt. of Documents.

results rather than as a treacherous or uncertain liability to be feared from day to day.

TESTS ON GOLD ALLOYS

In a study of the gold alloys, you will find more difficulties than for any other material. Operators do not agree on the properties necessary for a clasp gold, for an inlay gold or, in fact, for any gold. This is unfortunate but by no means fatal. Perhaps different operators require different golds for the same type of restoration. One may have extreme ideas on conservation of tooth substance and demand a hard gold which will not become distorted when cast in thin sections. If so, he should know what gold offers most in this respect. This requires physical testing of the gold by either the manufacturer or the operator. For an intelligent selection of gold, the operator should have a clear understanding of the meaning of all physical properties for the material in question.

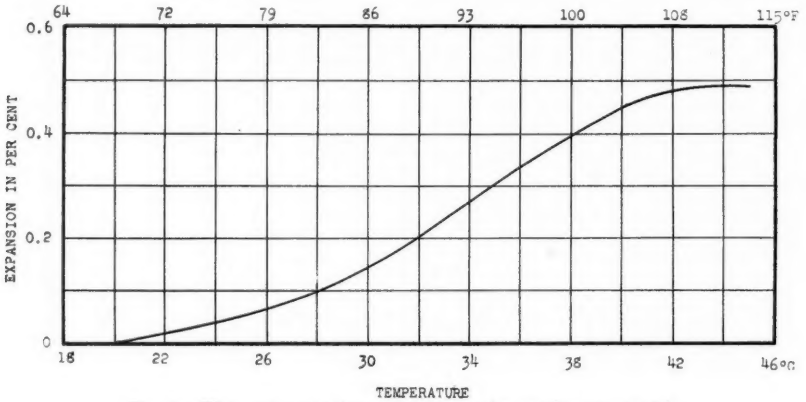

Fig. 7.—Thermal expansion curve for an impression compound.

ACKNOWLEDGMENTS

Numerous curves, illustrations and data appearing on succeeding pages of this paper are taken from previous publications[3] of the Bureau of Standards, in most instances from those resulting from the cooperative research with the Weinstein Research Laboratory during 1922-1928. This research was supervised by the Bureau, which assumes responsibility for the accuracy of the results published. For more complete definitions, explanations and applications the reader should refer to the original publications.

TENSILE TESTS

(a) *Elongation.*—Elongation is one of the most easily appreciated properties

3. In addition to those publications listed under Footnote 1, the following should be consulted: J. A. D. A., 11:249-250 (March) 1924; 12:509-546 (May) 1925. Dent. Cosmos., 68:743-764 (Aug.) 1926. J. A. D. A., 14:189-199 (Feb.) 1927. Dent. Cosmos, 69: 1007-1026 (Oct.) 1927. Bureau of Standards Scientific Paper No. 532, price, 10 cents, Supt. of Documents; reprinted, J. Dent. Res., 7 (Dec.) 1927. J. A. D. A., 15:627 (April) 1928. Proc. Fifth Annual Meeting Am. Ass'n Dent. Schools, March, 1928, p. 76; reprinted, Dent. Digest, 34:398 (June) 1928. J. A. D. A., 15:1053 (June) 1928. Bureau of Standards Research Paper No. 32, price, 35 cents, Supt. of Documents. J. A. D. A., 16:581 (April) 1929.

of an alloy and is obtained without difficulty. The usual practice is to place two gage marks on the wire, bar or rod being tested, at a definite distance apart, pull the specimen in a tensile testing machine (Fig. 5) until it ruptures; then assemble the two pieces and measure the new distance between the gage marks. The increase in distance divided by the original distance and multiplied by 100 gives the percentage elongation. Should the specimen fail at a point outside the gage marks a retest should be made as the elongation is always measured across the break in the specimen. This property indicates the degree of ductility to be anticipated in burnishing, bending or adjusting an inlay, clasp or appliance. Where the percentage elongation is below 1 per cent, appreciable bending and adjusting operations are not possible. There are many alloys having values under 1 per cent. Slight bendings of these are sure to produce fracture. Exact dimensions and instructions for the preparation of tensile specimens are indicated in the

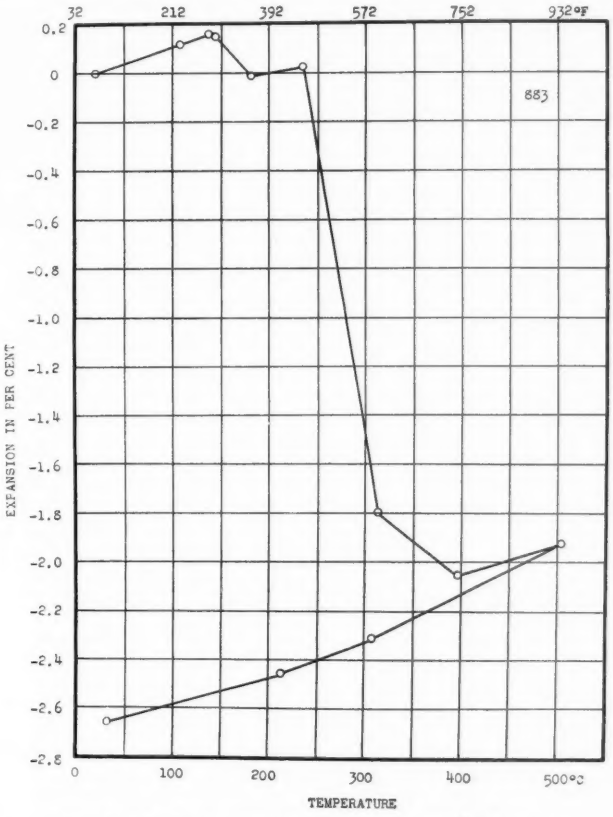

Fig. 8.—Thermal expansion curve for an artificial stone.

publications referred to in the paragraph above.

(b) *Proportional Limit.*—The property of elongation, when studied in connection with that of proportional limit, gives us an excellent idea of the service value of a clasp or bar attachment. The proportional limit is defined as the stress at which the deformation ceases to be proportional to the load, and, for practical purposes, especially in this beginning work, it may be regarded as the stress at which permanent deformation occurs. This stress is instantly recognized as the danger point in loading an appliance. If exceeded, the adjustment is changed and we have lost the adaptation and equalization of stress. The appliance is no longer as you made it and approved it for the case.

(c) *Ultimate Tensile Strength.*—The ultimate tensile strength is readily understood from the name and need not be elaborated here.

HARDNESS

Brinell hardness number gives us a measure of the resistance of a material to indentation and is to some degree related to the previously mentioned property. Numerous methods of measuring hardness are available, but the Brinell method appears to be most satisfactory for this work, especially when the smaller (one-sixteenth inch) ball and 14-pound or 28-pound loads are substituted for the regular ball and load which are too large for use on specimens of the sizes used in dental work. Figure 13 shows this equipment.

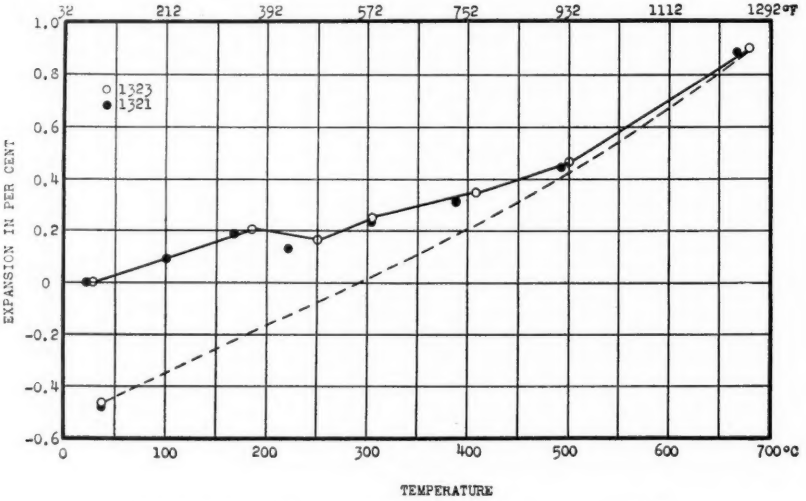

Fig. 9.—Thermal expansion curve for an investment material.

FUSION TEMPERATURE

The fusion temperature is arbitrarily defined as the lowest temperature at which a wire 0.020 inch in diameter and one-sixteenth inch long, supported at both ends, will break when subjected to a cross bending load of 3 ounces. The heating rate, within 50 C. of the break-

ing point, should be between 5 and 30 C. a minute. This temperature will be found to be neither the highest nor the lowest temperature in the melting range of an alloy but will be between these temperatures. This is a very important test for materials to be used in appliances subjected to soldering operations. The expert with the blowpipe can sometimes solder or melt into union two bars or wires having a melting point below the melting point of the solder used; but why should he be pushed to this extreme when a careful selection will make the operation so much simpler and more effective?

Figure 6 shows the general method used in this test. The alloy under test is first welded, in the oxyhydrogen flame, between the junction of a platinum-platinum rhodium thermocouple. The junction is next placed in an electrical furnace (not shown) and the temperature noted at which the welded alloy is parted by the 3-ounce load. Students will find no difficulty in performing this experiment if supervised by the instructor.

CHEMICAL COMPOSITION

Chemical composition by the wet method of analysis of individual elements will be found more difficult than we are accustomed to expect. Mr. Swanger spent several months in the cooperative research in developing a reliable method for the analysis of these complex gold platinum alloys. A separate publication[3] covers this subject. I am not competent to discuss it in any detail, but I am convinced that it is the most reliable method available at this date. Schools unable to carry out all details and precautions necessary in this method may secure fairly ac-

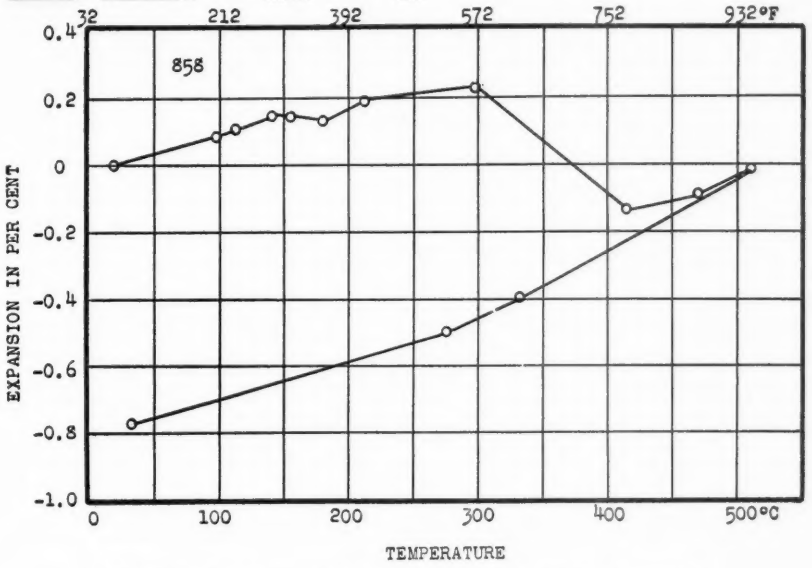

Fig. 10.—Thermal expansion curve for a second investment material.

curate data on the precious metals composition of alloys by the fire assay methods. Such tests often give information on the possible tarnish resisting properties of an alloy.

Perhaps at a later date we shall find less secrecy in the formulas, dimensional changes, temperature limitations and elastic values for dental supplies. Perhaps we may find dentists more intensely interested in these properties, understanding their significance and truly fascinated by the precision existing in this field of science.

After the data on each separate component have been secured, we are ready to assemble the findings in terms of the conditions met in practice.

TYPICAL CURVES OF PROPERTIES

For your records, I am including some curves showing the dimensional behavior of one impression material, two waxes, two investments and one artificial stone. These materials vary considerably, but the results from those included are illustrative of the problem.

Impression material chilled or allowed to cool from 110 to 75 F. (Fig. 7) will be found to be about 0.4 per cent undersize. If the model is poured from artificial stone and later the stone is heated to 700 F. as in casting a partial or single piece casting, a further shrinkage of 2 per cent (Fig. 8) will enter. What chance have we to cast an appliance to size under such conditions using the

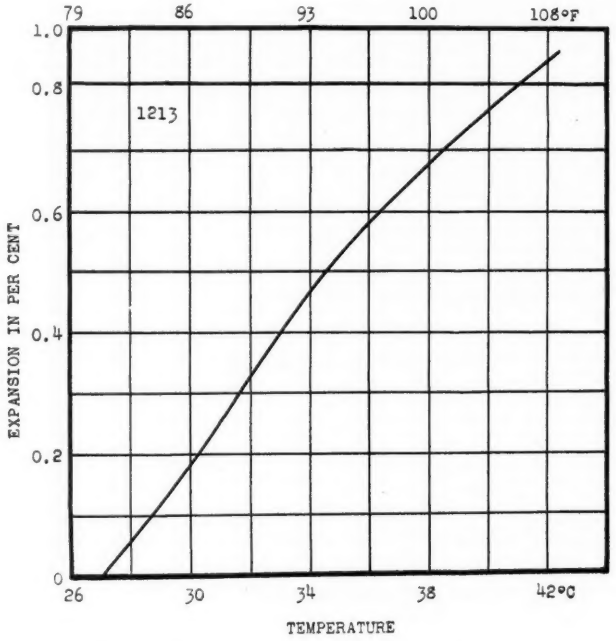

Fig. 11.—Thermal expansion curve for an inlay wax.

above materials plus an alloy which will show a further shrinkage on casting?

Figures 9 and 10 show the decided advantage in selecting the proper investment for expanded technics and casting at higher temperatures. Expansion curves of dental waxes are shown in Figures 11 and 12 and give us an excellent method for correcting, in advance, for the shrinkage of the gold alloy to be used.

PROPER REGARD FOR ESSENTIAL DATA

While I am on this subject of compensating for alloy shrinkage, I want to mention an experience which developed in 1927 when this idea was revived at the international meeting in Philadelphia. One technic was outlined showing how castings could be made to fit by expanding the wax pattern and investment mixture. During the discussion, a prominent teacher assured the meeting that, in his opinion, it was not necessary to exercise such rigid care in the observation of temperatures for compensation.

Hundreds of men have worked on the problem since, and other combinations of temperatures have been evolved for casting to dimensions. All these are founded on definite temperature intervals for wax and investment, such that the total expansions equal the shrinkage of gold alloy used. Not one has been evolved or revived which will produce results when temperature intervals for wax or investment are ignored; and why not? If the data in curves 9 and 11 mean anything, and there are definite properties of materials constant from day to day, how can we expect success except as we standardize our technic to comply with the standards or constants of materials?

DISCOVERY OF EXPANDED PATTERN TECHNIC

Now in order that there may be no misunderstanding or conclusion that I claim credit for the original technic of casting to dimension by the expanded pattern technic, I wish to quote from Van Horn,[4] who describes a method of casting which gives a result larger than the original wax pattern:

> The investment was mixed with water at 120° F. The flask was heated in the machine so that when the investment was poured in the flask, the latter was very uncomfortably hot to handle with the finger. The flask was at no time permitted to cool, but kept in a constantly increasing temperature until the cast was made, at which time it was at full red heat.

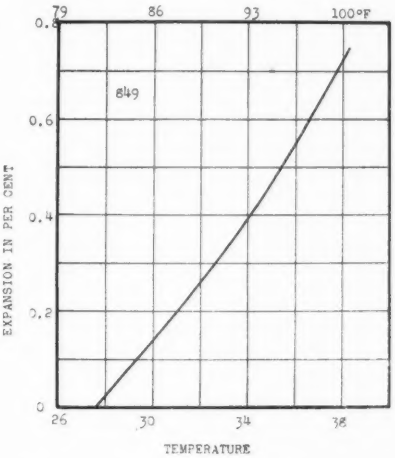

Fig. 12.—Thermal expansion curve for a second inlay wax.

From this experiment, he secured a net expansion of 1 per cent from pattern to casting. This reference also contains a quotation from Dr. Lane[5] in which he establishes the importance of casting into hot flasks when shrinkage of gold is to be reduced or partially compensated. In

4. Van Horn, C. S.: Dent. Cosmos, 52:877 (Aug.) 1910.

5. Lane, J. G.: Dent. Digest, 15:497 (July) 1909.

1911, Van Horn[6] added a further modification for accuracy in casting by investing with a slow setting investment and placing the flask in a water bath at 110 F., and as he states:

> The flask with its invested pattern is to remain in the water bath—no water coming in contact with the investment—without any change in temperature until the investment has thoroughly hardened, which takes about one-half hour.

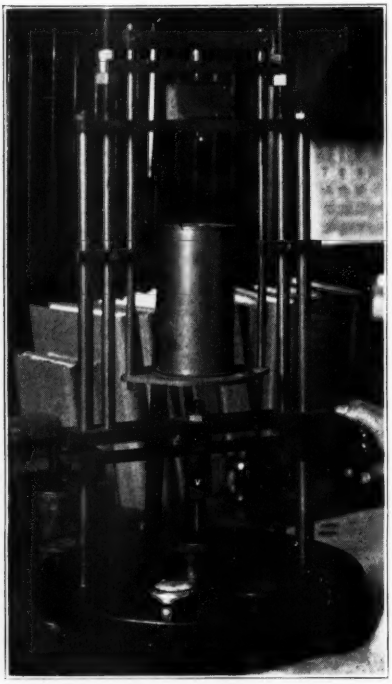

Fig. 13.—Baby Brinell hardness testing machine; the most suitable type for use in dental research.

PRECAUTION IN EXPANDING WAX

I can add nothing to this except to remind you that we now have more accurate data on the exact value of wax expansion, investment expansion and temperature control. Then there should be sounded a word of caution regarding the upper limit of temperature to which a wax pattern can be heated for expansion. This will vary with the composition of the wax. For many waxes, 110 F. is too high. Here is an opportunity for another laboratory exercise; namely, a determination of the safe upper limit for heating a wax pattern. For this, you will need a rod of wax, say one-eighth or three-sixteenth inch in diameter and 3 or 4 inches long. Heat the wax in a water bath or oven until soft enough for use in actual mouth work. Bend it into a narrow U pattern. Chill or allow to cool as in practice. Attach pins across the top of each prong of the U until the pins are in contact. Now place the wax in a bath and increase the temperature until the pin contacts start separating. Note the temperature at this instant and record it as the upper limit for expanding this wax. For a test of the effectiveness or defectiveness of the method for releasing stresses by cutting with a hot instrument, cut one of the U patterns with a hot instrument and repeat the experiment. The results of these experiments will vary enormously with the change of temperature of the wax at the time of bending, but I am sure you will agree, after making the experiments, that few waxes are permanent when heated above 105 F.

DENTAL SCHOOL VS. RESEARCH METHODS

Some of you may have noticed in this paper a tendency toward simpler equipment and experimental methods than in any previous publication from the Bureau. This is at once explained if we call attention to the difference between graduate college research work looking

6. Van Horn, C. S.: Dent. Cosmos, 53: 1113 (Oct.) 1911.

for the most precise results and undergraduate college laboratory experiments planned to instil into the mind of the student an analytic method for attacking and comprehending fundamentals. These are two distinct problems. Today, I am considering only the latter.

LABORATORY EXPERIMENTS AS A FOUNDATION

I have tried to bring to you examples of experiments which can be made on the physical properties of dental materials by the student in the dental school. These have been offered in the face of a schedule already crowded. No statement will be made as to what could or should be omitted to make room for these experiments. Emphasis should be placed on a consideration of what may be expected from a laboratory course including these ideas.

There is no substitute for laboratory work in the dental school. Text and lecture methods of instruction may make a student an excellent consultant, but will never make him an artist in dentistry. The laboratory exercise when properly carried out, written up, turned in and inspected brings to the student not only the facts discovered or verified but, in addition to these, an invaluable confidence in the rational and exact behavior of the materials investigated. He secures the feeling of mastery over the tools with which he is to work. They will not rise to haunt him as an uncertain, treacherous or hidden source of trouble at some later date. If properly presented, the science of mechanical dentistry will develop from a number of separate definite experiments collectively embodying all factors responsible for the work. Should trouble ever arise, the operator at once starts separating the factors into the individually contributing elements and will more often than otherwise locate the factor causing the trouble. Last but not least, he has a safe foundation for progress, discovery and advancement of his profession.

I want to assure you of the sincere interest of Dr. Burgess, director of the National Bureau of Standards, in cooperating with the dental profession and dental schools in any program which can be efficiently carried out at the Bureau. It has been a pleasure to me to prepare this paper for the consideration of your Association.

SIMPLE METHODS OF PREDETERMINING DESIRED RIDGE FORM OR TISSUE CONDITIONS AND THE ADVANTAGES OF A MATRIX OR IMMEDIATE RESTORATION FOLLOWING SURGERY*

By CLYDE H. SCHUYLER, D.D.S., New York City

THE ideal or more desirable ridge form has been often discussed; yet there is a great variance of opinion and, generally speaking, a lack of understanding between the prosthodontist and the oral surgeon. The ideal ridge is rather difficult to describe. Its fullness or length should not be such as to mar the restoration from the standpoint of excess fullness of the lips or the unsightly display of denture base material. Neither is it desirable to be obligated, owing to the absence of ridge fullness, to set the teeth far anterior to the ridge in order to produce the desired esthetic effect. The stability of an artificial denture depends largely on ridge support. To set either anterior or posterior teeth far outside the supporting ridge will result in leverage and consequent instability.

Alveolar ridges with the buccal and labial walls more nearly parallel or of a modified U-form give greater possibilities of retention and stability than those of the converging type. A common error in the removal of ridge fullness when removing the teeth is an excessive reduction of bony structure. The dense bony cortex of the buccolabial plate is easily removed as well as the septum, thus leaving little but the lingual plate creating the V-shaped ridge and necessitating the placing of teeth in a relation to the ridge crest that will create unnecessary leverages. In other words, there is danger of overestimating the amount of tissue to be removed to facilitate the insertion of a harmonious restoration.

In many instances, we find edentulous ridges with prominent tuberosities which interfere with the insertion and removal of a denture, or ridges so prominent that denture bases interfere with maxillomandibular relations or mandibular movements, or with the proper placing of the porcelain teeth. Such cases require, or are improved by, the more radical removal of alveolar structure, and often we find that the amount of tissue removed has not been sufficient in bulk to give ideal results. In all cases in which surgery is required as before mentioned, both maxillary and mandibular casts should be made and mounted for study purposes before the operation is attempted.

I have found immediate insertion of a matrix advisable where many teeth are to be extracted and prominent ridges or flabby tissue removed, and I think that a matrix might be an aid in other forms of surgery such as the removal of tumors or hard areas of the palate, where the antrum or nasal cavity might be involved, as such a matrix would act as a support

*Read at the Better Dentistry Meeting of the First District Dental Society of New York, Dec. 4, 1928.

or splint to the tissues while they were reuniting. In most cases, the matrix can be made in the form of a temporary denture, thus serving a double purpose.

The immediate insertion of a matrix apparently reduces the discomfort of the patient. Many times in the past few years, I have inserted restorations immediately after extraction, alveolectomy or the removal of soft flabby tissue. By proper preparation of the casts, the restoration served as a matrix or splint to hold the freshly cut areas in better relation and to protect them from irritation by the tongue.

The immediate insertion of the matrix aids in the formation of the desired blood clot and is of great value in controlling the excessive bleeding of a hemophiliac or postextraction hemorrhage.

These advantages, together with the elimination of the embarrassment and loss of time during the usual toothless period, which may range from two weeks to six months, is an important consideration with most patients. Also, it should be remembered that, during a long edentulous period, the tone of facial muscles is lost and facial expression is restored with greater difficulty.

The desired ridge form may be controlled to some extent by the use of the matrix, as the regeneration of the bony structures starts with the formation of a blood clot, and such formation is controlled by the form of the matrix. The matrix also insures and maintains the proper relation between the ridge crest and muscle attachments, when inserted immediately after extraction, removal of hypertrophy tissue, alveolectomy or the incision of undesirable attachments.

The principal disadvantage that I could suggest is the necessity for greater care and precision in the work of both the prosthodontist and oral surgeon as well as mutual understanding and cooperation. I think that the possibilities of infection have been greatly exaggerated. If the work has been carefully done by the oral surgeon, the denture properly sterilized and the patient instructed as to cleanliness, I can see no greater danger of infection even when the tissues are left unprotected. Patients should be instructed to use some good antiseptic to cleanse the matrix or denture, but the matrix should not be removed for several hours after the insertion and then great care must be used in washing the mouth lest blood clot formation be disturbed.

Immediate denture service has been practiced by some dentists more or less satisfactorily for many years, but to my knowledge Sears first introduced the transparent base of accurately predetermined form to be used by the oral surgeon as a guide in the preparation of the mouth. By placing this transparent base in the mouth, prominent areas, which interfere with the seating of the base, are readily detected, and the unnecessary sacrifice of supporting structure may be thus avoided. At the same time, it is made certain that no projections of bone will interfere with the insertion of a denture meeting the mechanical and esthetic requirements.

To construct successfully a temporary restoration or matrix as suggested, the best possible impressions are made before surgical preparation. Casts are made of plaster or stone, after which they are trimmed or corrected in such a way as to present the conditions desired after the completion of surgery. The restoration or matrix is then completed on the corrected cast.

To make the transparent trial base, a cast is made by pouring plaster into the finished matrix. Over this cast is then placed a sheet of 26-gage wax. This is

invested in a vulcanizing flask. The flask is then separated and the wax removed and replaced by a sheet of 26-gage transparent celluloid, which is formed to the cast by heating in boiling water and pressing in a flask press.

In some cases in which mandibular restorations are made after the removal of many teeth, I find it advisable to reline the denture base immediately with compound, relieving the pressure over the crest of the ridge in such a way as to prevent tension or pressure on the surgical tissues and permit the formation of the desirable smooth rounded ridge.

It is desirable for the prosthodontist to be present during mouth preparation. If the oral surgeon and prosthodontist are familiar with each other's procedures, it is quite possible to get the desired results when casts carefully made and marked to indicate the desired removal of tissue are accompanied by the transparent base. This procedure gives to the prosthodontist and to the oral surgeon an assurance of definite control not otherwise possible.

VALUE OF THE ROENTGENOGRAM IN ORAL DIAGNOSIS*

By E. C. HUME, D.D.S., F.A.C.D., Louisville, Ky.

THE many examples of neglect due to lack of use of the roentgen ray or failure to interpret the conditions as found by the roentgen ray have prompted me to again review some of the many things that I often wish I could have seen much earlier in their progress.

More and more each day, we are intrusted with our part of vital health problems. We are being consulted oftener by medical men than in the past. The standard of service rendered today by us as dentists is no longer limited to repair or replacement of the human teeth. Medical men are asking us to locate hidden foci of infection, to determine the cause of nervous disturbances; in other words, we are asked to make minute examinations of the tissue of the mouth that the physician may correlate our findings with those of his own, to the end that he may be able, after careful analysis of all facts before him, to arrive at a correct diagnosis and, if the condition is amenable to treatment, institute the treatment which will cure the patient if possible or retard or stop the progress of the disease if a cure is impossible. How well this service is being rendered by us as dentists it is not for me to say. Suffice it to say that the busy practitioner may use the roentgen ray consistently and make a careful study of his cases, finding many conditions which should have been found and eliminated long before they were ever discovered. Many such cases bring embarrassment to the man in charge of the case and grief to his patient, and, in some instances, marked deformity results after corrective treatment has been instituted.

*Read before the Section on Radiology at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1929.

I am not one of those who believe that the roentgen ray reveals all or is a cureall or that it was ever intended to take the place of the clinical picture; but there are many instances in which it should be used. For some reason or other, a great many of the men of our profession excuse themselves for not using it by saying they had no reason to suspect such trouble could be present.

The roentgen-ray examination, when attempted, should be a definite procedure following a definite technic, including an examination of all the teeth and their supporting structures. To get this, in many instances, the extra-oral films are necessary. How many of you have experienced the embarrassment of having a patient return complaining of pain shortly after you have completed his work, to find that you neglected to fill a proximal cavity at the last sitting, and that the pulp is now exposed? Or you have made a partial or full denture, and when your patient returns, you find a fragment of root or an impacted tooth or a piece of filling material in the tissue under this denture. Is it not a wise procedure to determine definitely whether or not the foundation upon which we build is free from disease and abnormalities before we start the construction of the replacement parts? You would not employ an architect to construct a large building for you or build a bridge across a stream and allow him to proceed with the erection of the superstructure before he had determined whether or not the foundation upon which he was building was secure. In many instances, we do that very thing in the human mouth, and such work built on a faulty foundation will just as surely result in disappointment and failure, as would the erection of the building or bridge across a stream.

Some of the conditions that are easily found and easily corrected are oftentimes neglected until the patient complains of pain, swelling, bleeding gums, etc., and returns to you or some one else (many patients do not go back to the man who did the work complained of) to have the conditions corrected, at which time it may be necessary to sacrifice the tooth or teeth involved. Among these conditions, you will find overhanging fillings, crowns, cement forced into the soft tissue by inlays or crowns, supernumerary teeth, malposed or impacted teeth, cysts and other destructive lesions of the tissues which support the teeth.

Supernumerary teeth are not so uncommon as one might think and are often the cause of noneruption of normal teeth, malposition of normal teeth, continual elongation or a progressive separation of the normal teeth. These conditions should be determined early by roentgen-ray examination at or before the time of eruption of the normal teeth when the teeth show progressive elongation or separation, regardless of the fact that such conditions may or may not have been corrected by grinding or placing some form of retaining appliance on them. Such teeth should be examined early. The supernumerary teeth that do most damage are those whose presence we never suspect until it is revealed by the roentgenogram. In some instances, large cysts form around supernumerary teeth, destroying the normal teeth and their supporting tissue. What excuse can we offer if we do not in all such conditions make an examination before the destruction of bone or normal teeth occurs?

Have we not seen many cases in which the second lower molars were lost owing to decay at points of contact of a partial or wholly unerupted third molar? And

when such a condition does occur in the mouths of patients who regularly visit us, who is at fault? Many times, patients tell us that no one ever suggested a roentgen-ray examination to them or that their dentist told them not to be concerned about a missing or impacted tooth unless it gave them trouble. When we consider the fact that the loss of such a second molar means the loss of the opposing tooth of the upper jaw and a considerable percentage of the masticating surface, is the problem not serious enough for us to give careful consideration to the prevention of such unfortunate conditions instead of trying to excuse ourselves for not having done so?

The upper third molar does not cause so much worry as the lower third, but this tooth rarely erupts in a perfect position. Many upper third molars do not erupt and are contributing causes to maxillary sinusitis due to cystic degeneration around crown end of this tooth, destroying the wall of and invading the sinus. Many upper third molars erupt buccally, decay early and produce ulcers in the buccal mucous membrane due to sharp roughened surfaces. Such conditions are the original site of malignant growths.

In the mouths of patients who come in regularly for dental care, I can see no reason why cysts should reach the proportions that they do. Careful routine examination, including the liberal use of the x-ray machine, would enable us to discover such conditions early in their development and thereby save ourselves the loss of many patients, and our patients the loss of many teeth. Some of the chief reasons for patients changing dentists I have mentioned in this paper. I am convinced that, in most cases in which considerable work has been done and teeth have been lost, our examinations are incomplete unless we make a full mouth roentgen-ray examination, and that much of the shifting from one dentist to another would be avoided if, in making an examination, we found all the existing conditions and advised our patients of the necessity of their correction. After correcting existing conditions to the best of our ability, a routine postoperative roentgen-ray examination is advised by some if there is any question as to the fit at gingival margins of fillings or crowns. Then is the time to determine definitely whether or not such conditions exist. After all, we are only human and will make sufficient mistakes to cause us worry and our patients dissatisfaction even when we utilize every known method to avoid such.

Let us give to our patients the service we would like to receive if our positions were reversed; warning them of the dangers of neglect, proving to them that we are interested in their general health and that we are anxious to prevent instead of repair, to preserve instead of destroy. Then and then only will we minimize our disappointments and that of the patient.

DISCUSSION

Louis Schultz, Chicago, Ill.: One of the most important factors in forcing closer cooperation between physician and dentist is the recognition of the far-reaching pathologic effects of focal infection on the human economy. The prominence of dental focal infection among such lesions has emphasized the necessity for cooperation. In this, each consultant should assume full responsibility in his chosen field. Thus, retention or extraction of questionable teeth, as well as the method of eradication of oral or dental infection, should be left entirely to the management of the dental practitioner. That he, on the other hand, must be competent to deal with such lesions in the best interest of his patient is obvious. Likewise, the difference in treatment, if any, of a patient who is bedridden or constitutionally ill owing to such infection and one

who is symptomless must also be left to the judgment of the consultant who specializes in that particular field. Determination of sites of oral infection is greatly aided by roentgenology, but the latter is an aid, albeit a very valuable one. To serve at all, it must be a well-focused picture, without distortions and not lacking a detail. A diagnosis should ordinarily not be made without a complete set of roentgenograms of both maxilla and mandible. Such a set may reveal unsuspected buried teeth, broken roots, cysts, foreign bodies, tumors, poor root canal fillings, poor restorations, beginning caries, disease in the maxillary sinuses, etc. Not long ago, I found a giant-cell tumor of the mandible in this way. In another case, this method of approach prevented futile mutilation by disclosing multiple myelosarcoma. Postoperative roentgenograms have frequently been strongly recommended as a check on root canal fillings, on healing after root resection, etc. Their value after extractions, especially that of impacted teeth, extensive bone tumors, large cysts, etc., should also be emphasized if only to serve as evidence that a possible subsequent spontaneous fracture was not caused by the operator. Invaluable as is roentgenography in this field, I repeat that it is an aid and should be used only as such. Paramount is a good history and the exercise of an unbiased judgment. That impacted third molars often cause the loss of the involved second molars through pressure atrophy or through caries of the distal root of the latter is well known, but I question strongly the statement, which we have all seen in print, that every impacted tooth is an infected one. My personal reaction is that impaction does not cause infection *per se,* nor does it give rise to a symptom complex of infection. Impaction may cause severe symptoms, such as violent headaches, simulating those encountered in brain tumor, various manifestations of neuralgia, mental phenomena, including mania, etc. But even in the presence of such disturbances, the discovery of an impaction as an etiologic factor should be accepted as such by exclusion only. A thorough, painstaking, searching inquiry into all other possible causes should precede such a diagnosis. Like Dr. Hume, I am convinced that only by practicing the golden rule can we minimize our disappointments and that of the patient.

C. S. Suddarth, Chicago, Ill.: In every discussion today, the point has been emphasized that an oral diagnosis is not to be rendered from a roentgenogram. That is true, and it is proper for every one to be clear on this point, but its overemphasis has made me feel like championing the cause of the roentgen ray in oral diagnosis, since overemphasis seems to have unduly minimized its import. Pathologic processes of insidious nature, unheralded by crying symptoms, escape detection until they have reached colossal proportions, when a roentgenogram would have revealed them in a much earlier state. Dr. Hume states that many who should have employed the roentgen ray excuse themselves for not having done so by saying they had no reason to suspect that such trouble could be present. This is no excuse at all. It is worse than no excuse. We have no license to take anything for granted in so vital a matter as oral diagnosis until we have proved it to be so, or at least have exhausted every means at our disposal to that end. Too many pathologic processes developing about the jaws give no subjective or objective symptoms or signs until they are well on their way, to say nothing of root fragments, impacted or incarcerated teeth, supernumerary teeth, etc., as Dr. Hume has pointed out. In view of the many advantages accruing to the patient through the agency of the roentgen ray and the small cost of this service, it appears highly advisable that the dentist insist on a complete roentgen-ray examination of the mouth of his patient before he undertakes any restorative work. It is not alone for the benefit of the patient but for the benefit and protection of the dentist as well. Who has not encountered this condition? Mr. X feels bad. He consults his physician. The physician orders an oral roentgen-ray examination. This reveals foci of infection and the physician orders the teeth out. "But," says Mr. X, "my dentist just finished this work for me and I paid him a considerable sum of money." The physician remains adamant, insisting on the elimination of oral disease regardless of the dental work in order to protect his patient's health. In what light does this place the dentist in the eyes of his former patient and in the eyes of the physician?

DENTAL PHYSIOLOGY*

By JAMES MARK PRIME, D.D.Sc., F.A.C.D., Omaha, Nebr.

THERE is no especial reason for presenting this subject before this Section. Other Sections should be equally interested.

Tooth-form function constitutes the groundwork of dentistry. The operator, periodontist, orthodontist and prosthodontist may well recognize its importance.

The defensive mechanisms of the blood stream, the semicircular canals of the ear, the endocrine gland system, the nervous system with its center in the brain, the seat of thought and memory, are examples of the great wisdom evidenced in this human mechanism. This same wonder-working incomprehensible something, pervading the whole organism, we find in the teeth.

The teeth make up a machine operating under physiologic and biologic laws. How little we understand these laws is evidenced by our limited knowledge of the diseases to which these organs are subjected.

Dental anatomists have given us complete descriptions of the forms of the teeth. This essay will be an effort to define some of the *functions* of a few of those tooth form characteristics.

We are disposed to assign the lack of interest in this subject to the fact that there has been no real purpose—no object, no scheme in design, no function—assigned to these characteristics.

Gray, in describing the various characteristics of bones or "points of interest," invariably gave the function. How much more important to know the functions of specialized characteristics of the teeth, since we are constantly called on to restore these in our work; while it is never required of the surgeon to restore a bone, or make thereon a roughened surface for the attachment of a muscle, etc.

Figure 1 shows specimens of three types of teeth. The carnivorous, the herbivorous and the omnivorous. While these teeth strongly suggest the types of food these animals should eat, they are more interesting in that they point very accurately to the fact that these animals have, for untold ages, eaten special types of food. The teeth become specialized to take care of certain types of food when the animal is compelled to subsist on these foods for long periods. Not only are the teeth modified to meet these requirements, but also, along with tooth modification, there develops a harmonious temporomandibular joint, which quite definitely predetermines mandibular movement, necessary to prepare these special foods to be taken care of by a specialized alimentary tract. These all become specialized and harmonious in function through the modifications resulting from subsisting on special types of food over long periods.

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That civilization has had a marked effect on the foods of man is reflected in his teeth. Civilized life has rendered his teeth less necessary, resulting in degradation in size, form and quality. By a definite law, Nature developed them for him, and by a reversal of the same law, he is losing them. As surely as he developed them through use, so surely will he lose them through disuse.

The carnivorous mandible functions on a hinge permitting only an open and shut movement. The deep intercuspal relation of the teeth, limiting lateral, protrusive or retrusive movements, tends to develop and maintain such a temporomandibular hinge-joint. Long use in masticating flesh and bone foods developed

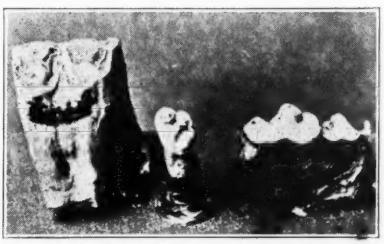

Fig. 1.—Three types of teeth, carnivorous, herbivorous and omnivorous. The omnivorous is a blending of the two other types.

the sharp deep-cusped molars; prehensile and defensive uses developed the cuspid, and gnawing fibers from the bones, the incisor teeth. The sharp bony fragments developed the protective cingulum, so pronounced in the teeth of these animals.

The herbivorous is strongly contrasted with the carnivorous. Instead of the pointed teeth, with their sharply sloping sides, we have a straight sided, flat occlusal surfaced cuboid tooth. The millstone-like occlusal surface of the herbivorous mandible permits a free lateral mandibular movement, unrestricted by the temporomandibular joint. These forms, together with the character of the food eaten, limit the excursions over the lateral surfaces; hence, there is no protective cingulum for gingival gum tissue.

As we might expect, we find in the omnivorous a remarkable blending of the characteristics of the two first mentioned, with all the mandibular movements of both the carnivorous and herbivorous and modified tooth form characteristic of both.

Our study of tooth-form function is confined to the fields of biology and mechanics. We must therefore go to Nature and inquire of her, and with our knowledge of simple mechanics, let her teach us her purposes in some of these seemingly simple and nearly constant characteristics.

When Louis Pasteur began his study of natural crystals, he constantly noticed a peculiar characteristic in crystals of paratartaric acid. Other investigators passed them by as meaningless. This did not satisfy the penetrating and inquiring mind of Pasteur. He constantly asked: Why this? He persisted until Nature gave up her secret to him, and thus was added to the world of science one of the many discoveries that make the name of Pasteur immortal.

We cannot pass by characteristics we find almost constantly without stopping to inquire: Why this? Let us find Nature's way and follow it. The first to which I invite your attention is what I have called occlusal constriction.

OCCLUSAL CONSTRICTION

Figure 2 shows molars with the Boley gage set on the marginal ridges which outline the occlusal surfaces, the gage unchanged being dropped down on the proximal surfaces. To our surprise, we find the occlusal surfaces practically one-half as wide as the crown through its

greatest diameter buccolingually. This ratio is about the average in unworn bicuspids and molars. Figure 3 shows the occlusal surfaces outlined with India ink, which gives a fairly accurate idea of the relative size of these surfaces as compared to the circumference of the entire crowns. Why is this?

There are many reasons why Nature developed this *sharpness* or *pointedness* of these occlusal surfaces. Some of the very simple reasons are that it: 1. Reduces the tendency to fracture. 2. Minimizes the work of the musculature, since, by the constriction, they may be more easily driven through the bolus. 3. Starts the excursions in a direction to divert them away from the gingivae. 4. Reduces the stress on the periodontium, thus minimizing the danger of traumatic injury. 5. Facilitates eruption. Its constricted occlusal surface tends to reduce backward pressure, and it may therefore more easily burrow its way through the tissues to its position in the arch. 6. Creates, by this constriction, an embrasure occlusally to the contact point. 7. Prevents biting or pinching the lingual and buccal tissues. 8. Favors prophylaxis of the tooth surfaces from the excursion.

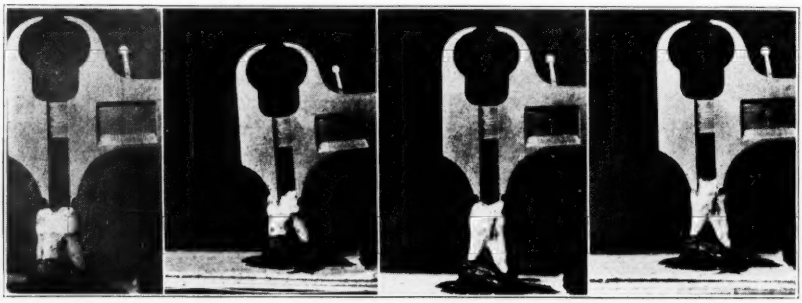

Fig. 2.—Boley gage set on marginal ridges of two molars. The gage placed on side of teeth gives the relative breadth of the occlusal surfaces with the greatest buccolingual diameter of the crowns.

DISTAL CONTOUR

Teeth are given form characteristics to compensate for their inclination in the arch. The upper incisors and cuspids incline labially and mesially. To compensate for the labial inclination, the lingual surface is formed to guide the excursions away from the linguogingival tissues. This function is aided by a linguogingival tubercle. On the labial surface, we find a curvature incisogingivally, which, among other functions, carries the labiogingival tissues into a well protected zone out of lines of force from the lower incisors and cuspids. The mesial inclination is compensated for by an almost straight mesial surface; while the distal is strongly curved, a tuberosity resulting, which protects the septal tissues. (Fig. 4.) This greater convexity on the distal surfaces is virtually constant, the more common exceptions being found in the lower cuspids and lower central incisors. The upper teeth incline outward and forward. The lower molars and bicuspids incline lingually and mesially. At the lower cuspid, the line of inclination changes,

which accounts for these teeth being conical and unlike the upper cuspids. (Fig. 5.) The lower incisors incline sharply to the labial aspect (Figs. 5 and 6) and have their contacts at the incisal edges. This is one of the reasons for the common irregularity found in these teeth. It is a difficult task for Nature to erupt them to their positions with their pinpoint contacts at their incisal edges. Furthermore, they form, by their incisal contacts, a continuous cutting edge, which gives us the cutting, blade function of these teeth. (Fig. 7.)

SPILLWAYS

We have made many errors in our efforts to reproduce the natural forms that is not broken by a spillway, permitting escapement of food over the ridge and into the wide lingual embrasure. (Figs. 8-9.) This performs a very definite function in that it limits the field of susceptibility, decreases the occlusal load or stress and gives tone to the large fibrous gum tissue forming the base of the lingual embrasure, which, in turn, is supported by a heavy mass of bone. Without this spillway, Nature's scheme is defeated.

Figure 9 is an enlarged photograph of extracted teeth. Observe the narrowing of the tubercle on the mesial of the first bicuspid to compensate for the narrow distal surface of the cuspid, with which

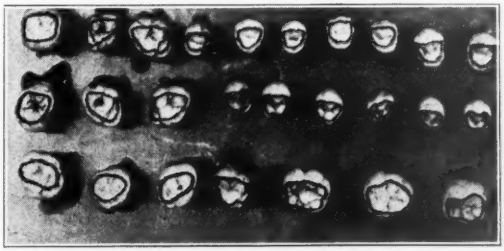

Fig. 3.—Outlining the marginal ridges defining the occlusal surfaces; showing their relative size as compared with the greatest circumference of the crowns.

of the teeth. My observation leads me to believe that perhaps the greatest single error is our failure to reproduce the *natural forms* of the mesial and distal marginal ridges, because we have not understood their functions.

Many years ago, I began showing lantern slides on this subject. I thought it so simple and axiomatic that it would be necessary to direct the attention of the profession to it only once and the old, high, sharp "nature faking" marginal ridges would be no more. I regret to say that we still see them. We rarely see a natural mesial or distal marginal ridge it forms one of the most beautiful and efficient contacts in the whole denture. Imagine a continuous ridge along the mesial and distal marginal ridges of these bicuspids, high and sharp, which we see operators make so often. I ask you, how would the food escape when the teeth are clenched? It would not and could not escape and the teeth would become lame, the septal tissue would hypertrophy and bleed, the proximal surfaces would be robbed of their prophylactic excursions and the field of susceptibility would be greatly enlarged. Furthermore, there would be a distortion of function of the

lower teeth, with results anything but good. See how the contacts are on a line *well* to the buccal, with wide lingual embrasures resulting. Note the wideness of the buccal cusps mesiodistally to form the contacts. Also, note that the marginal ridges shed the food perfectly from the contact points and the little supplemental grooves serve to deflect it from the contact points and toward the center of the teeth, then over the marginal ridges through the spillways into the lingual embrasures. Note the small lingual cusps, and how, being small, they create these lingual embrasures. The lingual cusps receive the greater part of the load, and because they are small, diminish the stresses and leverages to the periodontium. The wide embrasures on either side provide relief from stress. Notice the lingual cusps swinging slightly to the mesial aspect, a part of the scheme. If they did not, the lingual embrasure between the first bicuspid and cuspid would be unnecessarily wide and the embrasure between the bicuspid and first molar would be crowded and too small.

Fig. 4.—Lines representing the direction of force when the teeth are driven into a bolus. The tooth form, assisted by the inclination of the teeth in the arch, protects the tissues at *a*.

Much importance should be attached to placing the contacts as shown in Figure 9. We have noticed operators placing them midway buccolingually. The bicuspids have an important office by reason of their position in the arch and the size of their crowns in proportion to their roots. Nature wisely provided a strong bony encasement for the roots through a flattening mesiodistally which permits heavy bone septums between them. Figure 10 shows the relative size of the root at the gingival line as compared to the size of the crown. Not only does this provide a more substantial bony support but ample room also for a vigorous septal tissue.

Fig. 5.—Denture illustrating how the line of inclination changes on the cuspid tooth; which accounts for the long conical form of the lower cuspid, so different from the upper.

PILLARS OF THE BITE

The upper bicuspids close onto the interproximal contacts of the lowers and their cusps close into the embrasures. Were it not for the molars acting as stays or pillars, the bite would close by slight tooth movement, the upper bicuspids acting as wedges between the lower. Nature wisely provided against this by locking the bite on the molars. (Fig. 11.)

Cusps of molars closing into the fossae of their antagonists prevent the closing of the bite, with its trail of unfortunate sequelae. When this fact is appreciated, a greater value will be credited to the molars and their loss will be regarded a serious matter, particularly by women patients, in whom change in facial contour or dimensions is so objectionable.

CURVATURE OF OCCLUSAL SURFACES AND OCCLUSAL FUNCTION

The human denture, like those of the animals, was designed primarily for chewing the food and so preparing it for

Fig. 6.—Line drawn through the long axis of the lower incisors showing their inclination labially.

digestion. This is performed through the function of the occlusal and incisal surfaces. Our work approaches the ideal in proportion as we restore occlusion to harmony with Nature's laws. This is one of the important points of our subject. We have but one place to go for our information and that is the mouths of young people who have unworn, unmutilated dentures, fresh from the hand of Nature. If we are to understand Nature's scheme and purpose, we must study the teeth before they are deformed by either caries or wear. Worn facets, inclined planes or flat surfaces are acquired deformities.

We find the occlusal contact points by placing carbon paper between the teeth of these young people and asking them to close. (Fig. 12.) There are no flat surfaces on these teeth. The occlusal surfaces contact at points similar to the interproximal contacts. Enamel is the hardest and most wear resisting tissue formed by animal metabolism. Nature therefore went to the limit to build these forms in such a way that they would endure. She built the enamel tissue out of rods and so placed the rods that they would resist wear endwise. Is it not

Fig. 7.—Teeth showing contacts at the incisal edge, affording a continuous cutting blade function. The need for this accounts, in large measure, for the frequent irregularities of these teeth, since it is difficult for Nature to permit them to erupt in position with their pin-point contacts.

apparent that she wanted to preserve these forms?

THE TERM "INCLINED PLANE": A FALLACY

We find that there are no inclined planes on unworn teeth. As long as dentists think and talk in terms of inclined planes, they are outside the pale of normal, natural occlusion. This term has brought about a misconception of functional tooth form. It is time that we drop it from our textbooks on dental anatomy

and use it only in our literature, referring to it as an acquired deformity.

Figure 13 shows an inclined plane as described in Webster's New International Dictionary. From *C* to *B* is the inclined plane, which makes an oblique angle with the plane of the horizon, *A* to *B*. This surface, represented by the line from *C* to *B*, is smooth and straight. The word plane means, according to the same authority, "without elevations or depressions; even; level; flat; a surface of zero curvature." In other words, if it curves, it is not a plane; if it has elevations, it is not a plane; if it has depressions, it is not a plane; if it is not even, level or flat, it is not a plane. A plane is the zero of curvature or a surface from which all the elements of curvature have been removed.

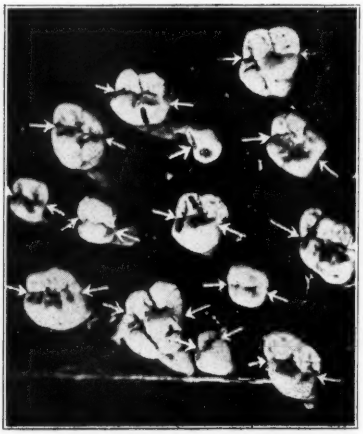

Fig. 8.—Teeth taken at random from collection of extracted teeth. The arrows point to the spillways.

In sharp contrast, we find the occlusal surfaces curved, ridged and tuberculated. The triangular ridges, tubercular in form, produce many of the points of occlusal contact, and Nature wisely placed at each side of the ridge a supplemental groove to permit escapement of the bolus and reduce leverage. The occlusal surface is the business end of the tooth, and we cannot give too much thought to the details of its anatomy.

In an exaggerated form, the occlusal surface contacts are comparable to three balls touching each other as in Figure 14. It is easy to see with what freedom the food escapes in all directions from these occlusal contact points, as indicated by the arrows. As the convex surfaces are worn away and the contact points are transformed into facets and inclined planes, they operate against each other, and stresses are greatly increased.

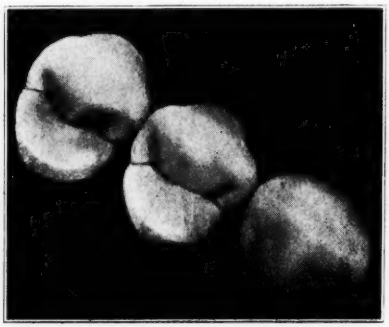

Fig. 9.—Teeth affording examples of spillways passing over the mesial and distal marginal ridges into the wide lingual embrasures.

Figure 15 is a drawing of a worn as compared with unworn bicuspids. In the unworn, the stresses fall very near the central axes, as illustrated by the parallel lines; while on the worn teeth, the stresses are not only much greater in degree but are spread over wider and more dangerous areas, within the parallel lines. As we leave the contact points of two convexities and reduce them to flat

surfaces, we multiply our leverages rapidly.

C. F. Stansbery drilled holes in a disk equal in size and an equal distance apart and the same in depth. He lubricated the surface and pressed warm compound against it with equal stress at all points, with the result shown in Figure 16. The material was carried deepest in the central holes and diminished as the periphery was approached. This gives us an accurate concept of the forces exerted by two large flattened areas operating against each other on deformed occlusal surfaces.

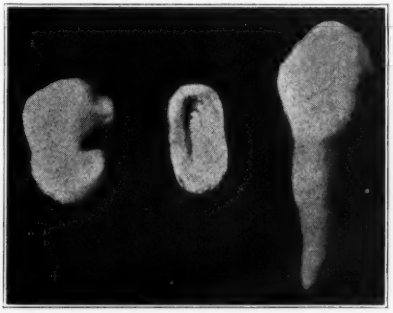

Fig. 10.—Marked gingival construction and flattening of roots mesiodistally.

TRAPS

The comminution of hard and fibrous food requires that it be repeatedly clenched between the occlusal surfaces. It must escape and get from between these surfaces, and Nature has wisely provided for this with gates in the form of embrasures, supplemental grooves, spillways, etc.

Figure 17 shows an upper second molar with four gates at *a, a, a* and *a*. It will be noted that its form makes trapping impossible. Excursions escape with a minimum of force by reason of these provisions. If fossae are filled or the marginal ridges are made too high and continuous and in so doing these gates are closed, it becomes apparent how the whole scheme is defeated.

It requires only a thought to contemplate what a distortion we get of this plan when we have our patient close on a piece of wax in central occlusion for inlays, crowns or pontics and then cast the wax and do not carve for gates or reliefs.

If we reduce the leverages and preserve the periodontium, we make our pontics smaller and embrasures wider,

Fig. 11.—Molars forming the pillars of the bite, their cusps locking into each other. Only through wear or loss of these teeth can the bite close.

and never omit a spillway or a gateway and keep our occlusal surfaces convex, after the master workman—Nature. Furthermore, we shall realize that the mandible is usually under control of the subconscious mind, and only when the patient uses the teeth in function can we determine the exact mandibular movements and occlusal relations. All surfaces involved in occlusion, from central

incisor to third molar, must be checked after the work is placed and trimmed as evidenced by the markings from unconscious use at the table. Herein, gold serves us much better than porcelain. A harmony of occlusal forms may be developed to a high degree in gold, while porcelain offers many obstacles.

When we have interfering convex surfaces and wish to reduce them, we will, if we wish to keep in harmony with Nature's plan, reduce the surfaces by grinding away and around the spot and carrying the whole surface down without

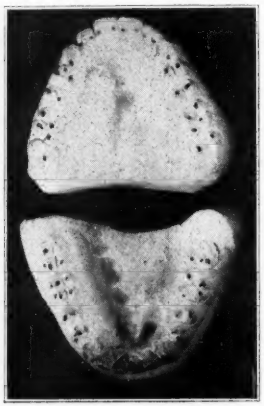

Fig. 12.—Casts of a child illustrating how unworn teeth occlude with small contact points. When the mandible is carried laterally while in occlusal contact, these small dots become fine lines.

creating an inclined plane, or worse, a concavity. The idea is to create forms meeting at contact points, at the same time keeping them as near the axial tooth line as the conditions will permit.

We cannot always imitate the natural, unworn, convex surfaces. If we are working in a mouth of unworn teeth, we must build restorations after the pattern in that mouth; if in the mouth where much wear has taken place, we must vary according to the conditions we find. It would be unwise to put a form characteristic of 15 years in the mouth of a patient 60 years old, and vice versa.

To test ourselves, let us take an impression of our work; after a model is made in plaster, we should not be able to detect our work. Exceptions would arise in bridgework cases, either removable or fixed, which, for good and sufficient reasons, should not wholly reproduce the natural forms.

MOLAR A MISNOMER

In times gone by, somebody saw a worn, mutilated human molar, and its flattened occlusal surfaces, which fitted perfectly corresponding surfaces of the

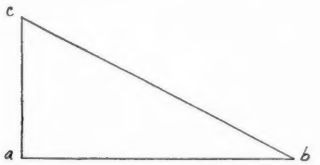

Fig. 13.—Inclined plane. The plane surface is represented by the line from *c* to *b*.

occluding teeth, suggested a millstone to him. He accordingly named it molar, from the Latin *molaris,* meaning mill. If he had seen such molars as are in the mouth of the patient from whom I made the cast shown in Figure 12, would he have gotten the idea of a mill? If he had observed how they make contact with each other only at points, a millstone would not have been suggested. Millstones do not touch each other at small contact points as is the case of unworn human molars. It is apparent that molars as Nature forms them function in the same manner as do the bicuspids. Both are shredders and not millstone-like in action.

Not all mills have millstones. A windmill, a planing-mill, a saw-mill and a woolen-mill have none. The entire denture could properly be called a masticating machine or mill. In this case, all the teeth would be a part of the mill. We could therefore with equal propriety call any of the teeth molars, since they would be a part of the masticating machine or mill. It is not likely that we will discontinue the term molar. It is well, however, that we understand the dissimilarity of the form and function of unworn molars as compared to millstones.

Our studies of the human digestive tract have taught us that it requires mechanical stimuli from fibers or particles not too finely ground. This brings us to see that the teeth are designed to function harmoniously with the tract to which they are important preparatory organs. If the molars grind, as do millstones, their function would be disharmonious with the tract of which they are a part.

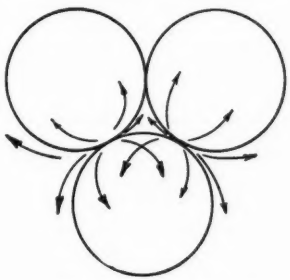

Fig. 14.—Circles representing three balls touching at small contact points similar to the manner in which unworn teeth occlude. Food can escape in all directions from the contact points illustrated by the arrows.

It is an interesting experiment to compare the results of chewing celery in patients whose occlusal surfaces are very different, as shown by the casts in Figure 18. It will be found that the one with worn teeth will crush the fibers to almost a complete pulp, while the other will only break and shred them. One patient is 46 years old and the other is 13. Is there any significance in the fact that periodontal disease is rarely known to the young patient, while we rarely see the other free from them?

The eyes of the dental profession are now focused on occlusion. Look at the program of this meeting. Occlusion has taken its place in the arena, and the flood light of our present knowledge is turned squarely on it.

The teeth are designed to function with a resisting bolus between their occlusal surfaces. They rarely cut through this bolus in the first clenches. A piece of ham, for instance, is clenched, and the resistance of the meat prevents the occlusal contact points reaching each other. The next clench will be in a new place on the ham with the same result, and not until the piece is well chopped and shredded and almost ready to swallow will the teeth begin to touch each other through it. If there had been a balance in the dentures, either natural or artificial, the effect of the balance would be lost until the bolus was sufficiently broken to need no further mastication.

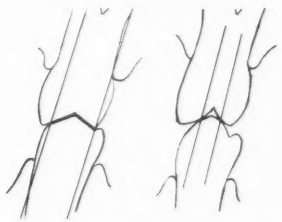

Fig. 15.—How worn and unworn teeth occlude. The stresses are spread over the occlusal surface of the worn teeth between the parallel lines, while the unworn convex surfaces hold them near the central axes of the teeth, illustrated also by the parallel lines.

Apparently, the prosthodontist has not taken this fact sufficiently into consideration but has built his dentures as if their only function were to glide over each other, tooth against tooth. We think the dentures should be built with the idea of the bolus being, during function, an ever-present factor. Such foods as require no comminution do not interfere with the balance nor does resisting food after it is comminuted. A factor to consider along with balance is an understanding of Nature's form scheme by which stresses and

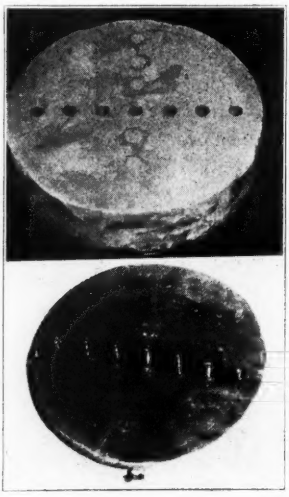

Fig. 16.—Result of pressing compound evenly against disk. The compound flowed deeply into the center holes while it only started to enter the holes near the periphery.

leverages on saddles and bases are reduced to the minimum.

This question may well be asked: If occlusal anatomy is so necessary, why do we see teeth doing such excellent work when their occlusal forms are worn away?

Nature's scheme is to produce maximum results with minimum labor. When the natural forms are intact and the teeth in normal position, overload is well nigh impossible.

The natural unworn teeth occlude at contact points as shown. As these contact points are worn to facets and the stresses are thereby increased, Nature sets up a physiologic defense by solidifying the supporting bone just where it is necessary, as shown by Hugh W. MacMillan. As the occlusal portion of the tooth is worn away and greater and greater stresses are brought to bear, Nature meets the condition with stronger and stronger bony support. If these stresses are outside the physiologic limits, the re-

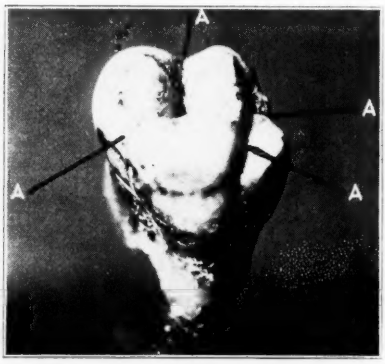

Fig. 17.—Enlarged photograph of molar showing impossibility of trapping of food since escapement may be made in four places (*A*).

sults are no longer a stimulus to defensive measures but react as trauma, with its inevitable results.

When we build up an individual tooth in part or the whole and put the extra load upon the periodontium all at once, before Nature has had time to fortify herself against it gradually, failure is invited.

The fact must not be overlooked that in teeth in which the occlusal third and

more is worn away, the lever is greatly shortened. Lateral stresses are the destructive stresses, and they are practically eliminated in these excessively worn cases. When we study Nature's scheme, we see the error of overly wide occlusal surfaces. We will create no occlusal traps out of which food cannot escape; we will see that spillways and gateways are reproduced as Nature so plainly teaches us. We will observe the wide lingual embrasures and reproduce them. When working in mouths in which natural forms are present, we make convex surfaces produce occlusal contact points instead of flat surfaces. We make bicuspid and molar pontics smaller to reduce the stress on abutments. We recognize Nature as the master builder.

Nature gives us an ideal to which we may work, but it is apparent that it cannot be universally applied.

With the desire to acquire, if possible, more definite information as to the variations in load and stress brought upon the periodontium through the deformities of wear, I designed the instrument shown in Figure 19. We recognize the fact that it registers only one line of force by reason of its only line of open and shut movement; but it seemed to me that it would be a help if only the centric force was registered and that put in such terms as we could understand. We also know that much less force would be required if the machine had all the movements characteristic of the mandible. We feel, however, that the results, while not wholly analogous with conditions in the mouth, do serve to demonstrate the rapidly multiplying leverages through the deformities of wear in the natural teeth and the fact that we increase the load on dentures through the careless grinding of porcelain teeth.

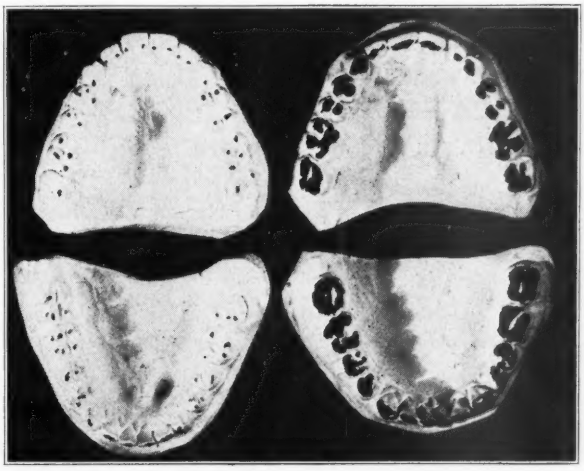

Fig. 18.—Effect of patients' biting in centric position on carbon paper, one having worn and the other unworn teeth.

Our first plan was to make tests on some form of food such as fried ham or celery stalks, but they were so variable in

their resistance that we discarded them. We then tried waxes, which answered our purpose much better.

Our first test was made on upper and lower full dentures. The teeth were not touched with a stone. They were waxed in central occlusion, vulcanized and mounted between the jaws of the instrument. We lubricated the surfaces with glycerin in all the tests, to simulate saliva. We then placed a square of wax 2¾ by 2¾ inches and 4 mm. thick between the occlusal surfaces, placed 115 pounds of

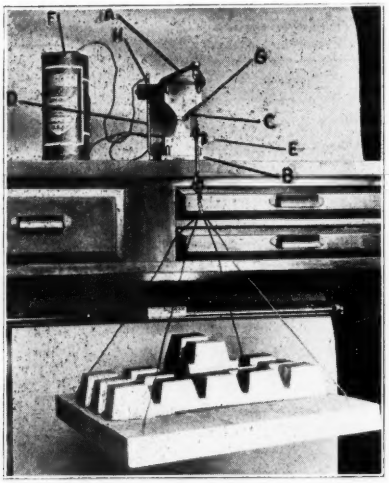

Fig. 19.—Instrument designed to register the variations in force as the result of acquired deformities through wear; made of two principal parts *A* and *B* and hinged at *C*. The teeth are set in plaster at *G*. An electric circuit through battery *F* and bulb *E* connects the upper and lower parts through wire *H*. When the upper member is lifted, the circuit is broken at *D*. Materials are placed between teeth at *G* and weight applied.

lead on the tray and suspended it from the ring in the upper jaw of the instrument. The room temperature was 75 degrees. The teeth cut through the wax and the bulb lighted in five minutes. The time varied only one-half minute in several tests. We then removed the unground dentures and mounted a set which were balanced by grinding in an adaptable articulator. They were ground more than is ordinarily required. (Fig. 20.) It took from sixty to seventy-five minutes to light the bulb in four tests. Two of the waxes are shown in Figure 21. We then made several tests with unworn extracted teeth, employing an upper second molar with a lower second molar. It is apparent that we could not use such heavy

Fig. 20.—Markings from carbon paper on dentures ground to what is supposed to be balanced occlusion. If the prosthodontist succeeded in imitating one natural characteristic, it was senility.

weights, nor was it necessary. Twenty-five pounds was placed on the tray and we used baseplate wax 1.3 mm. cut in 1-inch squares. The first five tests were made with the convex cusp surfaces touching at small contact points. The room temperature was 78 degrees. The time required to light the bulb ranged from one-quarter to three-quarters minute. The contact points were then reduced

by spot grinding to about twice their area. They measured after grinding 1.5 mm. wide. Five tests were again made. Time to cut through and light the bulb ranged from three to six and one-quarter minutes. The spots were again ground to the size of 2.5 mm., and five tests were made ranging from ten and a half minutes to seventeen and a half minutes. Teeth were again spot ground, but much more than before to bring greater stress areas into relation. Two tests were made at the same room temperature. The time required to light the bulb was one hour and twenty minutes.

DISCUSSION

Frank A. Hamilton, Indianapolis, Ind.: It is reassuring to observe that the dental profession is at last looking beyond the engrossing study of the details of the technic of crown, bridge, inlay and denture construction and the study of minute dental anatomy, to a broader view of the problems of tooth function, that each element of tooth form is but a part; and trying to find reasons for these specialized forms. Because the human dentition happens to be made up of thirty-two separate units, the investigator is all too liable to consider each individual unit or tooth separately, to the exclusion of the broader view that one tooth can never function alone, and that it is only when the two arches, each composed of sixteen smaller units, are considered in proper relation to the other that a correct conception of tooth function can be obtained. Do not understand that a thorough knowledge of detailed dental anatomy can be dispensed with; it is absolutely indispensable, but unless we are willing to unite all the elements which compose the dental mechanism in one unit, it is impossible to reach a correct understanding of tooth function. Until each tooth is properly supported by, and associated with, its fellows in a normal way, tooth function cannot properly take place, and then and only then can the significance of tooth form be comprehended. Then the value of each groove, ridge and cusp becomes apparent, and the functioning of the masticating elements is more fully understood. Also, unless the idea is well established in our minds that it takes much more than thirty-two well formed and normally arranged teeth to make up the masticating mechanism, we will be laboring under a handicap which will make the solution of this problem more difficult. As Dr. Prime says, the teeth are but the terminus or working surfaces of the chewing mechanism, and are, therefore, but one part of the larger unit which is composed of the maxilla, mandible, the temporomandibular joint, the muscles and ligaments controlling the movements of the mandible, the teeth and supporting tissues, the tongue, cheeks and lips, and until an effort is made to consider the functioning of this whole group of organs, no correct idea of the functioning of one group—the teeth—can be possible, and there can be no doubt

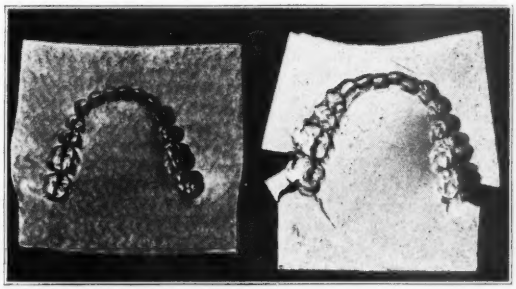

Fig. 21.—Waxes showing results of ground versus unground porcelain teeth. The unground teeth cut through the wax easily and quickly and did not distort the wax, while the ground teeth crushed and broke the wax and required over 6,500 per cent more force.

that if any omission of functional form is to be permitted, it is better to omit detailed occlusal tooth form than the correct relation of the teeth in the arches, for the destructive trauma resulting from incorrect mandibular relation will far outdo the advantages of correct detailed tooth form in incorrect relation. The loss of much of the occlusal enamel in an advanced stage of wear, where the supporting tissues are often healthy and efficient mastication is possible may be cited as an illustration of this fact. Exception must be taken to one of Dr. Prime's statements, his definition of the occlusal surfaces shown in Figure 3. In this, part of the occlusal surfaces are marked with India ink to emphasize the relatively small size of this area, as compared with the cross-section area of the whole tooth. This is misleading and gives an incorrect conception of the functional relation of these teeth. This is more readily understood when they are considered in connection with their functioning members, when it will be observed that at least part of the buccal surface of the lower and lingual surface of the upper is really occlusal. Admitting that the constriction of the occlusal portion of the molar, for example, may be of benefit in producing a somewhat pointed form to more easily penetrate food in chewing, the fact remains that much more of the tooth is in occlusion during some phases of mastication than just the surface between the cusps and the cusps themselves. Also as in the case of the lower molar, some of the surfaces so marked as occlusal serve more preferably to balance the denture, and to hold the food in place as a form of marginal ridge, while it is crushed and torn by the opposite teeth.

Again taking Dr. Prime's interpretation of the significance of the marginal ridge and applying the rule of observing it in action when working against, or in conjunction with, its functioning member, it becomes obvious that at the angle at which the inclined surfaces of the cusps meet their opponent, a marginal ridge is necessary as a sort of dam to hold the food until it is crushed. Without this ridge, food would slip from between the teeth too easily to admit of crushing. If Dr. Prime had shown but one slide, that of the bicuspids and cuspid in correct proximal relation, the period devoted to this paper would have been profitably spent. The contact points of these teeth were so beautifully shown and the form of the lingual portion of the bicuspids so well illustrated that the factors going to make up this result could be properly discussed for hours without exhausting the subject. Much could be said of the loss of the marginal ridges and sharp cusps when in the earlier stages of wear as age advances the marginal ridges and sharp cusps disappear with no marked loss of masticating efficiency. Is it not possible that with the loss of sharp-edged masticating tools, there comes a compensating development of the muscles of mastication by which their increased strength and increased freedom in the temporomandibular joint may make up for the loss of form efficiency, and is it not possible that the lingual constriction of the molars and bicuspids meets every requirement as waste gates or spillways? Also has proper consideration been given the tongue for its indispensable assistance in placing and holding food between the teeth during mastication? Dr. Prime very properly calls attention to the great importance of the preservation of the first molars and the serious results following their loss. It is very probable that if we could honestly say one tooth is more important to the welfare of the mouth than another, that important place should be given to the first molars; for, without them, normal functioning of the denture is impossible, as he well says, the strong lingual cusps, particularly the mesiolingual, playing an indispensable part in maintaining occlusal balance. Dr. Prime has shown beautifully the character of the contacts between the occlusal surfaces of freshly erupted teeth and their opponents and calls attention to the fact that these contacts are similar to the contacts of the proximal surfaces of the teeth when in fairly normal relation; also to the fact that, in wear, these surfaces never become true incline planes. This is impossible when the character of the mandibular joint is considered, but perhaps he did not call sufficient attention to the fact that, in natural dentures, the occlusal surfaces do not meet in direct vertical closure, but in a gliding lateral movement, which greatly increases their shearing and grinding power. Even in much worn teeth, the surfaces are not smooth curved surfaces but much roughened. This is necessarily so, because of the varying resistance to wear of the enamel and dentin, and these then provide a very fair grinding surface. However, this must not be accepted as an argument in favor of the smooth surface denture. There can be

no doubt that the fully developed anatomic forms are much more effective in mastication than worn surfaces can be. It would not be possible to emphasize too strongly Dr. Prime's suggestion as to the value of making models of completed restorations. Then and then only can an idea be gotten of the anatomic correctness of the restorations.

Dr. Prime (closing): Dr. Hamilton is quite right in seeing the teeth in relation to their fellows. "No tooth functions alone." Let it not be overlooked that a group of teeth cannot function properly unless the units making up the group are of a high order, including their investing structures. There can be no question about the function of worn teeth. It is easily understood why they are so firmly imbedded in solid bone. It is not safe to think this form may be applied to dentures when teeth are supplied. The reasons are set forth, we think, in the essay. Balance is a vital factor, but it must not be secured at the expense of other and equally important characteristics. Dr. Hamilton again is right in that the buccal surfaces of the lower molars and bicuspids act as occlusal surfaces. Teeth do not function directly end to end, so to speak. The constricted occlusal surfaces to which Dr. Hamilton takes exception will be appreciated as a wise provision of Nature if we give them thoughtful consideration.

RESEARCH AND TEACHING*

By U. G. RICKERT, A.M., D.D.S., Ann Arbor, Mich.

WITH few exceptions, American dental investigations until 1910 were directed toward the improvement of the esthetic and functional stability of restorations. With the advent of the focal infection concept, the latitude of dental interests and research was greatly extended. It was generally recognized by the educators that the future dentist must be better trained in the general sciences if we were to develop a reasonable number of research workers and also to meet most effectively the newer requirements of health service. In fact, there was a time when the profession dreamed of and visualized for the future a superpractitioner. To meet the new situation, the curriculum was reorganized and lengthened. Recently, there has been an increasing skepticism as to the results of this venture. To a large number of observers, the recent creation is not measuring up to the expectations of its designers. They say the new model in actual performance has so far failed to prove a superiority over the old commensurate with the added years of study.

As our university is situated on one of the several transcontinental railroad lines, we have the good fortune of having many educators and other leaders of the profession visit our school in their travels from east to west and vice versa. By both zealous correspondents and these visiting guests, we are asked with increasing frequency: "What about the future status of dentistry? Are we really increasing our capacity for service to the extent that we had dreamed of in the recent past, or are we again willing to continue as a craft of skilful appliance makers? Is dentistry going to be a profession that you would advise for your

*Read before the Research Session at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 26, 1929.

son? Is it going to win the respect and confidence that medicine and other of the learned professions have won, or is our capacity for service so limited and our economic conditions such that the individual dentist must continue to be more concerned about the business of making a living than he is about the future status of his profession?"

These are questions that are disturbing many thinking dentists. If the educational leadership is going to be as forward looking as it should be, and if we hope even to approximate what we so recently set out to do, it behooves us to turn our united attention to the conditions that threaten a continued progressive development. The destiny of the profession is tremendously influenced by the quality of instruction in the dental schools. If it is true, as many zealous observers insist, that the recent graduates are becoming more susceptible to the sacrificing of professional ideals for the more commercialized point of view, we, the teachers of dentistry, have failed to accomplish what we, a few years ago, set out to do.

Our first disappointment was met by the addition of one more year, largely cultural, to the course of study. When this failed to give us the results that we had anticipated, we added another year, and another, until finally it seems that we have acquired the habit of adding one more year of study whenever we do not know just what else to do to appear progressive. This venture has been praiseworthy as far as good intentions are concerned, but, to many observers, it is failing in actual achievement. I am not so much disturbed about the recent evident changes in professional life as I am about the immediate future. There is at the present time a great deal of dissatisfaction with the teaching methods in every educational division, from the kindergarten through the university. Therefore, any questioning of our present system is only evidence that dentistry too is in tune with the present trend in education. What the educators of the time should be more concerned about is what subjects are taught, and how such subjects should be presented. We need research as to what constitutes the most adequate dental training. The lengthening of an empirically planned course of study alone has not and will not increase our capacity to give better service nor improve the status of dentistry. There is every reason to believe that we have increased the term of years of study much more rapidly than we have established, by constructive research, information and facts essential to the training of dental practitioners capable of most effectively serving the common interests of society. This requirement is, after all, the final test of any educational system. Briefly stated, well-established research results have not kept pace with the curriculum.

RESEARCH

While we have made a beginning, it is true that if dentistry is to make the most of its present opportunities, it must first increase and improve the quality of its research results, and finally it must develop a greater number of adequately trained teachers. The very status and existence of the future profession are dependent on these two inseparable educational forces. These will require more financial support than has so far been available. Each year, we are graduating a number of qualified students who would willingly elect research and teaching as a life work if they were financially able to do so. When these students are approached with our inadequately remunerative propositions, we are usually told that it is impossible because the long

and expensive course has necessitated debts and accruing interest, and that the most remunerative field of work must be engaged in at once. The possibilities and necessity for investigations in dentistry are so urgent that some way of more suitably financing research and teachers' salaries must become available. We could not at this time pass unmentioned the assistance of the individual members of the profession, for there is perhaps no other health service group in which three-fourths of the entire membership make an annual individual contribution to research. Whether these funds have been efficiently or only judiciously spent needs no comment at this time other than to call your attention to the obvious inadequacy of the amount in proportion to our needs.

Last year, two and one-third billions of dollars was given by philanthropically minded wealthy Americans for the bettering of humanity. Millions of this went into hospitals, medical research, etc., but isn't it strange that practically none of it became available for dental research? One hears again and again from leaders of the profession complaints regarding this state of affairs. But could it be otherwise as long as we fail to approach our biologic problems by more rational measures and constructive research? We do not desire to project the time-honored pulpless tooth problem into this discussion further than to illustrate our point and to ask you whether you believe that we can afford to throw up our hands and continue to advocate the easiest way out: extract teeth, make plates and bridges, and be satisfied. With these limitations, can we expect to attract research funds from outside the profession, since our achievements still seem to give altogether too freely the general impression that dentistry offers only one more way of earning a livelihood. Unless we contribute more to pure science, is it likely that the state, scientific foundations or philanthropically minded financiers, schooled in the hard business world, will evaluate us otherwise? The public does not admire scientific medicine today for its prescriptions of crutches and artificial limbs: it rightly respects the mechanics, who so skilfully made these necessities, but it appreciates medicine rather for the refinement of some of its specialties, particularly for its surgical technic.

The achievements of the mechanical aspects of dentistry have been phenomenal. When the more biologic aspect of our practices measure up equally well with the mechanical practices, we shall truly have become a profession. At the present time, we are unable to avail ourselves of all of this splendid mechanical advancement because of limitations due to physiologic interference. Much harm is done because our mechanical skill is so far ahead of our biologic understanding. To give but one illustration: Of what value is a mechanically perfect restoration, if it fails to provide adequate protection against subsequent pulp and alveolar changes? This is of especial interest now since, during the past few years, it has been repeatedly proved that such pulp changes are associated with some of the more general health involvements. Research for the protection of vital pulps from the insults of dental restorations is second in importance only to the major problem of the causes and control of caries. The conception that the best of us have as to the causes of pulp changes and the full significance of this problem is still far from complete. This is only one of the many problems for useful research in the dental field. In fact, dentistry has a number of unique

possibilities that should bring us into closer contact with the general sciences and enable us to help clarify some of the medical problems. For example, about all that is known today concerning the causes and control of arthritis has been learned from clinical experience. While some investigators have suspected this, from clinical observations alone, from our own dental investigations we have considerable clinical evidence coupled with experimental studies indicating that arthritis is closely associated with protein sensitization. While these split proteins are usually associated with foci of infection, this need not and frequently is not true. Because, then, of the singular anatomy of the tooth, dentistry has a unique approach to the study of this problem. For this reason, we should make the most of our opportunity.

The final solution and infallible proof may require a great amount of time and work, probably more than one experimental worker can accomplish alone; but it is within our reach. (Time will not permit a more complete and detailed discussion.) Some may say, "Why spend our time with medical problems?" My answer is that if we desire to abandon this talk about health service and continue only as appliance makers, the question is justifiable.

We have another interesting contact in the field of bacteriology. There is no other organ from which cultures of bacteria, with probable metastatic experience, may be taken with the same assurance of freedom from contamination as the root canal of an unextracted tooth. (The detailed technic is given elsewhere in the literature.) We have opened many teeth with dead pulps, which were infected with organisms not normal inhabitants of the mouth that must have been carried to the tooth through the circulation. This is especially evident when dental cultures prove identical with the flora from the lower part of the intestinal tract. The cultural characteristics from these cultures are so nearly identical with those obtained from other foci far removed from the mouth that they have proved valuable in the preparation of experimental vaccines, and other bacteriologic studies.

Then, too, the technic for increasing the virulence of organisms in the laboratory is still crude and uncertain. Think of the opportunities from study of the cultures taken from the infected but slowly degenerating pulps. With the perfect protection because of the firm enclosure within the tooth, the most nearly ideal condition conceivable for increasing the virulence of the organism is made possible. The circulation in these cases still conveys the necessary nutrient materials for continuous growth and, at the same time, removes the toxic bacterial excretion, which, if not removed, would destroy the organisms themselves in a few days. This condition permits the most vicious of all dental infections, and as long as the dentists persist in supplying us with an abundance of this material, we should make the most of our opportunities. These illustrations of striking possibilities for research in dentistry and of interest to general science are only a few of those with which we are familiar. Other fields are probably just as fruitful as mine.

TEACHING

Impressive teaching and research are so nearly identical in their ultimate aims that one becomes an inspiration to the other. Fortunate is the school in which the majority of the teaching staff are sufficiently interested and amply provided with facilities to carry on well ordered research. My views are so nearly in ac-

cord with the statements made in a recent paper by Wallace Seccombe that I shall take the liberty of quoting him.

> While research may be carried on quite independent of teaching, real vital teaching cannot be carried on independent of research. To limit teaching strictly within the circumscribed area of things known would be to rob teaching of its vivifying force. When a teacher ceases to learn, he ceases to truly teach. . . . The spirit of research is the very soul of teaching and its influence should permeate not only the universities but colleges and schools of all grades. . . . It is just as essential to the life of the teacher to strive to know the unknown as to teach the known.

If the dental teachers fail to assume leadership in research, who will do it? The dean of the institution with which I am associated has been persistent in insisting not only that the schools should determine by research what constitutes ideal dental practices but also that the teachers should decide what materials best meet our requirements, rather than to depend on the biased investigations of commercialized interests. The tendencies in this direction have already assumed threatening proportions, when considered from the best interest of the profession.

For nine years, I was a student in several different universities, and I consequently was compelled to take courses from a large number of professors. I observed that there were, of course, two types of teachers, the interesting and the uninteresting. There were those who came into the classroom overflowing with enthusiasm, who held the attention of the student to the extent that it was not a hardship to sit listening intently for an hour. There were those of the other type, men who made it evident that they themselves at best had read the textbook only an hour or so before the student had read it. The lectures were given as if the subject matter was as hazy in the mind of the teacher as it must have been to the student. The first, the inspired teacher, presented his subjects so well that, after fifteen years, I can still remember the contents of a considerable number of these lectures. But as to the second type, I have even forgotten their names, let alone the subject matter. This time was entirely lost. We believe that since the schools, by our present system of teaching, seem to be determined to lecture the student to death, the work should be accomplished in as humane a way as possible. Only inspiring and well-trained teachers can do it humanely.

It was not until later in my experience when I had the opportunity of observing the enthusiasm and inspiration of the laboratory research workers, that I appreciated why it was that some men were teachers while others were not.

We shall portray two dental teachers taken from life—X and Y. X has, by the help of certain laboratory technicians, unnamed in his clinic, given the impression that he is an artist in his field. The dean of a dental department becomes convinced that this operator should be teaching dental students. X is told that of course the compensation that is possible for such teaching is inadequate, but that the prestige acquired because of the connection with the school of dentistry will more than compensate for the lost time by an increased private practice. X goes on with his major interests in his office, where he is compelled to earn his living, and quite rightly so. A few minutes before the hour, he is reminded by his office attendant that he must meet his class. The first thing that he thinks of is, What will I say? X has told me himself that before that hour is up, he frequently wonders what will be left to give his class during another period.

Students are keen observers. They are not inspired by this kind of teaching.

Let us turn to Y. He is personally carrying on certain lines of investigation. He is of necessity a student of the literature. He is in the laboratory early and late, not because of a time clock but from overflowing interest in the work. The students attend his classes because they realize that if they absent themselves, they are missing something worth while. And so the dental schools do have their X and Y teachers. For the best interests of dentistry, we must increase the Y's at the expense of the X's.

I was impressed at the January meeting of the Chicago Dental Society with the brief reports that were given in a certain section by the graduate students directed by an inspired teacher. Each one added an important bit of information, fundamental to dental practice.

Again, during the past year, I have had the opportunity of observing a number of younger men in our own school becoming interested in research. They are consequently rapidly improving their teaching. There is only one significant danger, which is not a serious one. It does occasionally happen that teachers become so enthusiastic in their experimental studies that they may and do slight their teaching. In fact, one of the most outstanding research workers in the field of organic chemistry once told me that "university life would be wonderful if it were not for the students." Yet this teacher, who taught too few hours, and only graduate students, conducted himself in the most inspiring manner in the classroom.

One would need but to turn to that master science worker and teacher, the late G. V. Black, to prove his point. In fact, this great teacher so impressed his students with the fundamentals that he had established by experimental studies that they cannot to this day realize that had the great teacher been able to live and carry on with the vitality and energy of his earlier days, he would be many steps ahead of the point where he left off. He would not have been standing still, as some of his followers at the present time are doing.

SUMMARY AND CONCLUSION

Bringing this into the immediate field of dental education, it must be evident to every dean that, with few exceptions, his most outstanding teachers are enthusiastically engaged in the investigation of some problem in their immediate field, and that ways and means must be found to permit more teachers in the dental schools to make experimental work a hobby if we are to increase most effectively the quality of teaching. It is evident that funds must become available for both research and teachers' salaries, if dentistry is to make the most of its opportunities. We have a number of unique problems giving us an advantage in the solution of problems in both pure science and medicine. Research in dental education should be earnestly and seriously prosecuted. It appears that we have increased the term of years of study in the dental schools more rapidly than we have added facts essential to the training of a more capable practitioner. This condition has added so much to the cost of dental education that it is more difficult to interest the best qualified students to remain in the schools as teachers and research workers because of greater indebtedness. The next five or ten years will decide whether we are going to expand and increase our usefulness or whether we are again to revert to a skilful craft of appliance makers.

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THE PRESENT STATE OF DENTISTRY IN SOVIET RUSSIA

By I. A. GERSHANSKI, M.D., D.D.S., Odessa, United States of Soviet Russia

THE course pursued by Soviet dentistry during the eleven years since the revolution is very interesting. There were new paths laid down in the reorganization of dentistry in Russia. Glancing back over the road, we see three principal features, organizational, social and scientific.

The reorganization of dentistry upon a new social basis has necessitated the expenditure of much energy, toil and perseverance in reaching the end aimed at.

Not only has clean scientific and theoretic work been carried on, with the aim of raising the standard of knowledge of our dentists by acquainting them with all branches of the science, but also, in a steady and continuous manner, they have been brought closely in touch, in practice, with the new methods of treatment of disease of the masticatory apparatus, as a result of the revolution, and have been taught how to apply modern prophylactic and sanitary methods to the field of dentistry.

During the reign of czardom, dentistry was in a state of extreme debasement in Russia.

At that time, the organization of dentists and their professional education was far from being up to date, a circumstance which no doubt had a bad effect on the entire state of dentistry in general.

From 1891 up to the year 1917, dentistry was taught in private dental schools, with a course extending over two and one-half years.

Persons who had graduated could not acquire sufficient theoretic preparatory knowledge nor adequate clinical experience, not being in touch with the general purposes of medicine, of which dentistry constitutes only a branch.

The dentistry of the prerevolutionary period was deprived of any scientific laboratory work of investigation, research and observation.

At the present time, the profession of the dentist in Russia is delivered from the yoke of serfdom. The dentist now enjoys public recognition and esteem to the same extent as the physicians belonging to other medical branches.

The activity of our fellows in the field of science, as awakened by the revolution, is becoming strengthened and broadened, for they have been given the possibility of working in organized scientific institutions, laboratories, etc.

The new social basis has attracted the attention of wide circles of Russian dentists, for the revolution has brought about a radical change in the nature of dentistry in this country, and the question of community dentistry has become important.

Dentistry in Soviet Russia has been organized and built up by Prof. P. Dauge, chief of the Dental Section of the Medical Division of the Commissariat of Public Health, and one of the most eminent Russian dentists. He has displayed an extraordinary amount of energy and capability. In reorganizing

the entire profession, Professor Dauge invited the cooperation of experienced specialists and, with their assistance, he has introduced dental relief work for the masses based upon new and more rational foundations, guaranteeing a proper level of qualification for such relief work and the realization of scientific methods in fighting the diseases of the oral cavity.

One of the most valuable achievements was the radical reform and the transfer of the teaching of dentistry to medical colleges.

The matter of granting to dentistry equal rights with other branches at our universities proved to be far from easy.

Nevertheless, the deep faith of the Russian dentists in the logic of this idea has rendered it possible to keep up the newly established chairs of dentistry.

The motto: "To be a dentist, you must become a physician" was well received and acted on.

There were chairs of dentistry established in quite a number of cities: Moscow, Leningrad, Saratov, Tomsk, Irkutsk, Kharkov, Kazan, Kiev, Odessa, etc., to which the State has granted sufficient funds to enable them to carry on adequate scientific research work.

During a comparatively short period of time, these chairs have developed surprisingly, and they are now the disseminators of dental knowledge. Besides, owing to the organization of these chairs, a number of very valuable works on the various branches of dentistry have appeared, representing a material acquisition to Russian dentistry.

Besides, for the time being, four public institutions of dentistry have been established: at Moscow, Odessa, Leningrad and Minsk, with the purpose of improving the qualifications of the former staffs of dentists, acquainting them with all the new achievements in the field of dentistry and the development of scientific research work in this field.

These comparatively young institutions have already succeeded in laying a deep and solid foundation for future building, and great things are to be expected.

The Third Dental Meeting of the Union, held in June of 1928 at Leningrad, brought forth quite a number of rather interesting and valuable works by both the faculty of dentistry and the graduates of these institutions.

Furthermore, the public health department has been paying special attention to the organization of state dentistry in Soviet Russia. While in the past, dental relief was only within the reach of well-to-do people and was administered by private practicing dentists, nowadays it is within reach of the laboring masses.

One further aim of state dentistry is to render regular and qualified dental aid to those employed by the State and public institutions at the expense of these institutions.

The main contingent of the population to whom dental treatment is rendered consists of those who are insured for this purpose, and the members of their families. Those working in factories in which the nature of the work injuriously affects the oral regions are given first consideration.

The fundamental principle of Soviet dentistry is the application of prophylactic methods and the prevention of dental disease from early childhood.

For the purpose of rendering rational dental aid, there have been organized in this immense country a number of state dental clinical hospitals, dental ambulatories and other institutions, which are either independent or are connected with general medical establishments, rural medical departments, large factories,

medical railway service, schools, the army, etc. At the same time, the task of rationalizing the dental service is being carried on by means of introducing for the dentists in the large dental polyclinic hospitals the so-called "working-units" and "prophylactic minimum," which render it possible, on the one side, to improve the quality of the work and, on the other, to get an exact record of the work performed by the dentists. In the dental institutions of Soviet Russia, the dentists are working five hours a day.

Special attention is being paid to prophylactic dental treatment, and we are enabled to obtain good results at a comparatively small expenditure of funds by applying the sanatation methods of Professor Kantorowicz, of Bonn, Germany.

The material assistance rendered by the department of social insurance enables us to furnish adequate dental prosthesis to insured laborers and office clerks. A feature of great importance in this respect is the strict differentiation of work in the large dental institutions. This is furthered by the use of proper equipment, electrification, employment of a staff of assistants and the participation of sufficiently qualified dentists; which renders it possible to place the whole matter of dentistry upon a proper basis.

The new problems raised in this great historical period have united the masses of dentists who, with great enthusiasm, devoted themselves to the best features of the new social order. Out of the total number of dentists in Russia, amounting to about 10,000 persons, more than 60 per cent are employed in state and public institutions. Private dental practice is small and is steadily decreasing year by year.

The professional and social level of dentists in Russia was markedly raised by the adoption of measures facilitating the transition from individual to group treatment.

The development of dentistry and the task of fighting the diseases of the oral region arising from the war, famine and various epidemics, have naturally necessitated increasing the knowledge of our dentists, whose work, at the present time, is not isolated as previously, but is carried on among physicians of other branches; in consequence of which, the dentists are endeavoring to acquire broader knowledge. This desire for better qualifications is felt by the vast majority of Russian dentists.

Besides the above mentioned state institutions, and apart from a number of repetitional lectures, there were organized, by several of the dental associations, various groups for the study of roentgenography and conservative surgical prosthetic, social and other branches in which, in addition to various scientific lectures, practical demonstrations are given.

It would be difficult to cover in this short and incomplete article all sides of the development of dentistry in Soviet Russia during this organization period.

The period of growth of dentistry in Russia coincided with the time when the profession was making important progress in Western Europe, and especially in the United States. Research in this science has also developed greatly during this period in our country, and its scientific achievements are advancing the position of dentistry. New problems were confronted and solved, such as the effect of oral sepsis as a source of infection, on the general health.

In this connection, the treatment of the diseases of the pulp, the pericementum and the mucous membranes of the oral region, surgery, roentgenography,

new methods of cure, of prosthesis, etc., became the center of attention.

The development of scientific work was to no small extent furthered by the literature received from abroad and by the publication of new Russian dental journals and other scientific works, the organization of congresses, in 1923, 1925 and 1928, a number of regional meetings, scientific conferences, etc.

All of the foregoing has, to a great extent, advanced the qualifications of the Russian dentists, enabling them to meet the demands of present-day life.

Great progress has also been made in the field of rendering dental aid to school children. There were many institutions established which, at the present time, are looking after the sanitary condition of the months of school children at regular intervals. In consequence of this, the number of children with caries of the teeth is steadily decreasing year by year; whereas, the number of children having sound and filled teeth increases.

Nevertheless, considering the enormous population in the Soviet republics, it must be confessed that adequate dental relief is not yet afforded, especially in the rural districts.

On the average, in the towns, there is one dentist to every 5,000 inhabitants; whereas, in the villages, the proportion is one to 20,000. It is to be hoped that with the improvement in general conditions and with the increase of economic prosperity, dentistry, which has made a successful beginning and is being carried on in the same way, will further develop; which will bring us nearer the end aimed at: dental care for the entire population.

It is worth mentioning in conclusion that the importation of dental equipment from abroad has considerably decreased, owing to a corresponding increase in the manufacture of the greater part of materials, tools, etc., used in dentistry, in Russia.

THE MANAGEMENT OF THE ORTHODONTIC CLINIC*

By ARTHUR L. MORSE, D.D.S., Boston, Mass.

THERE is a more or less widespread and growing discontent with the clinic in orthodontics among the educators of dentistry, the graduates and even the undergraduates. The mere fact that the management of the clinic is proposed as a topic for discussion at this meeting is an evidence of this fact. However widespread and deep this discontent may be, it is also honest and sympathetic, prompted by our devotion to the profession, which means so much to us and to our patients. "If there is an apparent impatience to solve the problem, it is because we are anxious friends and honest lovers of a good thing, of whose slightest deterioration we are jealous." We would keep orthodontics from falling short of its best. Thus it is that the orthodontic

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clinic is brought up for review and its management is opened for discussion.

We would approach the subject in the spirit which strives to reach a true conception of the correct management of the clinic and its relation to the other subject and departments of dentistry, not to prove a theory.

The clinic in orthodontics has always held a place in the undergraduate curriculum of the dental school. As long as it met the requirements imposed by a knowledge of orthodontics, and supplied the demands of the graduate in his relations with his patients, while the technical requirements were simple, the clinic found a comfortable and undisputed berth along with the other subjects taught in the dental school.

This happy condition has passed with the rapid and profound changes which have taken place in dentistry. Admittedly dental education is now in the midst of an attempt to determine the relative values of any subject of instruction given the undergraduate. We are passing through the process of examination of the fundamentals on which practice is based. This is a period of analysis whereby many ideas and theories long held to be true are bending and even breaking under the weight of clinical experience and additional knowledge. Because the machinery of education must ever grind on, turning out its product, the results of the analytic process, the newer knowledge gained thereby, must be combined with the old so that, in the working of the whole, there will be produced no grave disharmony. Our problem is to determine the value of the clinic in orthodontics.

The question is the management of the clinic itself. The term "management" is interpreted to refer to the purpose of the clinic, to its place in the dental curriculum in teaching safe and sane orthodontics for the well-being of patients and to the general way of accomplishing this result, rather than to the detail of handling the clinic. Therefore, we will not deal with the routine of handling applicants for admission, the specific mechanical devices to be used in treatment, the best time of day to hold the clinic or the relations of the different clinical officers to each other. All these things might be discussed with some profit, but they are secondary and must follow a discussion of the management of the clinic as an element in the instruction in the undergraduate curriculum in dentistry.

Our situation is this: The objective of dental training has been gradually changing for a great many years. The growing complexity of dentistry has resulted in the division of instruction into several departments which are administrated by men especially trained, men whose interest is centered around certain definite phases of dental practice. As teachers, they have ceased to look upon themselves as related in any responsible way to dental instruction or to dental practice as a whole, or to what the prospective dentist will be called on to do once he is launched into general practice. They conceive their whole duty to be performed when they have given their lecture or demonstrated their technical procedure. Their teaching is merely an interpretation of their favorite line of dental service.

The development of orthodontia has been along similar lines. In fact, the separation is even more marked here than in some of the other branches. On superficial examination, it appears to have developed a body of fundamental knowledge and a technical procedure which is peculiarly its own. The end sought in treatment is different: it is corrective;

while in most of the other branches it is reparative. This difference has resulted in orthodontia developing into a distinct specialty. There can be no doubt that a separation has come about between so-called general dentistry and orthodontia, and the indications are that the division will widen and deepen in the future unless something happens to bring them together. The result as far as the clinic is concerned is that it has lost contact with dentistry as a whole.

Even though this peculiar development has taken place, and in spite of the fact that the clinic has lost touch with the rest of the teaching, the clinic is still part of the instruction which the undergraduate is required to take. And our problem is to determine, if possible, how to manage this clinic so that it will play a vital rôle in the instruction. If we are to do our duty to the student and to the public, the policy we follow must be both safe in practice and based on reason.

Only a comparatively short time ago, when all dentistry was almost wholly mechanical and there was little realization of the broader physiologic significance of the problem, it was only natural that the clinic in orthodontics should be so managed that it too expressed a mechanical point of view. The efforts in such a clinic were all devoted to demonstrating and teaching the mechanical devices used in treatment, and the undergraduate was given an opportunity to practice moving teeth. Thus, he became an operator in the clinic and the clinic became a visible expression of the concept held of the field of orthodontia.

The question as to whether the undergraduate should continue to treat cases in the clinic is one which causes a great deal of concern. There are those who insist that the undergraduate have an opportunity to gain what they call practical work in orthodontics. Their argument is that many of the graduates of the dental schools must practice in communities which do not support specialists; that most of the people live in the so-called rural districts, and that most of the population cannot pay the fees of the specialists. They point out that there is a greater demand for orthodontic service even in the cities than can be supplied or is being supplied by the specialists. These supporters of the undergraduate operator in the clinic say that the students in the clinics under their management are capable of producing very creditable results, and to support their contention they present casts of the mouths of patients so treated. They assert that the clinic so managed performs a community service in their vicinity by rendering orthodontic service to the needy.

These arguments appeal both to our imagination and to our desire to be of service to others. They are so plausible that they have served to maintain the undergraduate in the clinic. From them, it is easy to build up a mental picture of the clinic in which the student can receive training that will fit him to render service in places where it is most needed, with profit to himself and benefit to others. If we let our imagination dwell on this picture of the clinic, our wishes to see it fulfilled becomes father to the thought that it has been or at least is possible to bring about this condition. But when we look at the clinic so managed with a background of clinical experience, we find that these arguments speak only of the instances in which the clinic has made good—they indicate the hits made, but do not tell us of the misses. They tell us nothing of the failures to produce results.

Those who praise the undergraduate operator do not seem to realize that

whatever good results are obtained are not the results of the student's work but are in reality the work of the instructor, who consciously, or unconsciously, uses the student as an instrument to carry out his own ideas—ideas the result of long clinical experience. Orthodontics is almost unique in this regard. Our operations are not completed in a day or a week, but require many months, and no undergraduate is likely to see both the beginning and the end of any particular case. When the student graduates, he cannot carry away with him the experience of the instructor. What he does carry away with him is a little knowledge of tooth movement and an exaggerated notion of his ability to treat malocclusion. The young graduate starts out bravely enough, but, in most instances, he is soon forced to abandon the attempt to treat malocclusion. He comes to the idea either that orthodontia is of little benefit, because the results are short lived, or that he is not fitted or prepared to pursue this line of endeavor. Here, we have an unfortunate state of affairs—"the supreme misfortune where theory outstrips performance."

Clinical orthodontia cannot be "picked up" in so brief a time as is alloted to it in the undergraduate curriculum. Clinical orthodontia is something more—it is a great deal more than the application of a few mechanical principles to moving teeth. As a matter of fact, clinical orthodontia is a subject which is mastered only by years of long, hard experience.

The key to this whole question of the management of the clinic lies in the objective of instruction in orthodontics. Whether or not the undergraduate should treat cases depends on the answer to this question. The desirability of the undergraduate operating in the clinic appeals to those who think in terms of the dental technician. We have been turning out dental technicians so long that it is difficult to think in any other terms. Yet the trend of dental education is away from such a course and its dangers are obvious, for "no art can progress very far unless the principles upon which it is based are known and appreciated." It is in the dental school that the student should receive the broad preliminary training which underlies dentistry.

This indicates the primary function of the clinic in orthodontics. It is to teach the undergraduates those things which are fundamental not only in orthodontics, but also in general dentistry—those things which are useful and necessary knowledge in the practice of all branches. A clinic so managed will give the student a foundation upon which to superimpose the advances that may, and surely will come during his professional life.

The real purpose of the clinic is to create an orthodontic conscience in the undergraduate, not alone for the sake of orthodontics as such, but for dentistry as well. By orthodontic conscience, we mean that the student should be made to see in the occlusal phenomena those things which endanger the health of the teeth and the surrounding tissues, and the factors which may or will influence the future development, or that interfere with the normal function of that whole complex of structures of which the teeth are but mutually dependent organs.

The orthodontic conscience of the student cannot be aroused so well nor so effectively, if it can be aroused at all, in the clinic so managed that its sole object is to teach the mechanics of tooth movement. When the student is the operator in the clinic, the emphasis must be placed on the details of the mechanics of treatment; that is to say that the fundamentals of diagnosis and prognosis must be sacri-

ficed. There is a danger to the student and to his patients if he becomes lost in the study of these particulars.

The clinic should be thought of as a problem in dentistry rather than as a strictly orthodontic problem. There is a place and a very real need for a clinic whose purpose it is to show the relation of the knowledge of orthodontics to the practice of dentistry. There is no other clinic where this knowledge can be so well impressed on the mind of the student as the clinic in orthodontics. The cases selected for treatment should have the end in view that they shall illustrate the rôle of the dentist in guiding or influencing the development of the arches. There are many cases which show the need of simple dental treatment which, if instituted, will release developmental processes out of all proportion to the work done and of great consequence to the patient; to name only one instance: those cases in which some deciduous tooth or teeth have been retained too long, which, if removed, would permit development to proceed. Here we have a dental problem, but it has an orthodontic background. Here we see illustrated factors in etiology that can be driven home in a way impossible in any amount of talking in lectures. The student can see for himself the results of treatment: he can see the tooth erupt and the dental arch progress in development as a result of simple treatment. This is practical treatment. It is practical knowledge that can be put into practice in rural communities and city districts. It will serve the dentist and his patients better than all the effort that he might have expended in an endeavor to make the teeth assume the positions of an impossible ideal. When we teach orthodontia from this angle, it takes on a real significance—it becomes a vital element in the daily life of the average dentist.

There are cases presenting themselves at the clinic which illustrate normal variational tendencies. At first sight, they appear to indicate treatment, but, if left alone, they will correct themselves. Of course, some do and some do not. The undergraduate should see such cases, study the models and observe the patient under the direction of the instructor. Thus, the student will receive first-hand information regarding developmental processes from the visual side and perhaps will begin to appreciate their significance.

There are other cases, such as the lingual position of the upper central and lateral incisors, which can be brought into typical relations quickly and easily. Even if some of these are not carried, and some do not need to be carried, to the point in occlusion that would satisfy an idealist, they will have served their teaching purpose; much good will have been done to the patient, and the student will have learned a lesson that will be of value to him.

Besides these, there are the cases which have become complicated through the lack of timely dental assistance such as it is the duty of the general dentist to render. Here, the student should have the opportunity to see many environmental factors within the control of the general dentist, which, if permitted to exist, must surely divert normal development, but, if corrected, will permit development to proceed along its correct course. Here is an opportunity to teach principles that are practical and practicable anywhere. It can be shown how intelligent dentistry may be a factor in prevention and how a lack of it can be a factor in causation of malocclusion. A clinic so managed finds an honorable

place and should be welcomed in the dental curriculum. It puts orthodontia into dentistry; it establishes a contact that has been lost.

There are other cases which do not originate through any lack of dental assistance: they exist in spite of it. They are evidence of development gone wrong. To be complete, the clinic must include of these. Some are so complicated, the principles of treatment are so involved and they present such intricate problems that their teaching value is almost negative. They are hospital cases and should have no place in the clinic, except that they should be exhibited for what they are. The clinic should not be thought of as a hospital. The good it does is purely incidental. The clinic in orthodontics is purely educational.

The cases selected for treatment should show typical conditions of malocclusion and their treatment should be demonstrated. Here, the student may observe the modern methods used in treatment, study diagnosis and prognosis and see the changes effected in occlusion. The mind of the student should be directed to the effects that a change in the environment brings about so that the information gained may be transferred to the practice and procedures in dentistry. In this way, the student may gain an appreciation of orthodontia and may come to the realization of what it can mean in the life of an individual.

In the clinic managed as suggested, it may be pointed out that the undergraduate does not have an opportunity to practice tooth movement and, secondly, it may be claimed that the way to learn to do a thing is to do it. The first is admitted and the force of the second is recognized. In reply, let us point out that the treatment of malocclusion is complicated, requiring a peculiar technic which is not developed in the other branches of dentistry and is not easily acquired. On the other hand, tooth movement is a relatively simple thing. One of the greatest mistakes that can be made in the management of the clinic is to teach the undergraduate how easy it is to move teeth. When the time of the instructor and the student is all devoted to devising means to this end, there is little time left for a discussion as to why a tooth should be moved. Just because a tooth can be moved is no justification for moving it. It is vastly more important that the undergraduate know why we move a tooth, and to anticipate the consequence of moving it, than it is to know how.

While it is true that we learn by doing, it is also true that we must hear about what we are to do, then see the thing done, before attempting to do it. Hearing, seeing, and then doing is the natural way of learning. There does not seem to be any good reason for changing the order in the study of orthodontics. The undergraduate is in the hearing and seeing stage of development while he is in the dental school; he has a lifetime to practice doing.

CONCLUSION

Let us realize that the whole curriculum of the dental school is in the process of reorganization. The old order of things must give way to progress, and while we must hold fast to that which is good, the false and the useless must be cast out. There is a new type of student coming to the dental school and he will demand that his dental training stand foursquare with his predental training. He will not long tolerate the kind of instruction that has been accepted. The new order of things is upon us now, and we must make haste to put our house in order.

The old idea regarding the management of the orthodontic clinic, based on the impossible idea that tooth movement is sufficient unto itself, an idea that fostered a divorce of orthodontics from dentistry while it pretended to unite them, must give way to an idea in management that seeks to create an orthodontic conscience in the dentist and to lay a foundation for future progress.

The clinic of the future must be a vital element in the training of the dentist, not as a demonstration of orthodontic technic and method, but to illustrate orthodontic principles in the every-day practice of dentistry. This is not shown so well, if it is shown at all, when the undergraduate is the operator. True we learn by doing, but this is only another way of saying that we learn by applying, and this can be done and should be done in the other clinics of the dental school.

My plea is this: Now that we have deliberately set ourselves the task of making the orthodontic clinic play a vital rôle in the undergraduate training, let us reorganize on the simple conception that the course in orthodontics supplemented by the clinic is only the formal side of the course, but that its contacts with dentistry and the application of orthodontic principles in the practice of general dentistry are its realities.

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DISCUSSION

Burne O. Sippy, Chicago, Ill.: I am thoroughly in accord with the principles of teaching in the undergraduate curriculum outlined by Dr. Morse. Since the reorganization of our school, when it became a part of the University of Illinois, the department of orthodontia has continuously stood for such principles. The orthodontia clinic was developed and has been maintained upon such a basis. With increased experience as time passes, and in keeping pace with the development of orthodontia, coupled with the recent review of the dental curriculum as a whole as to its fitness, our position is strengthened rather than weakened. I am able, therefore, to discuss only the spirit embodied in this presentation rather than its details, in the hope of strengthening the position taken. Dentistry has grown so broad that no one can hope to excel in all its responsibilities. The general practitioner of medicine is an honored and respected person in past history. The general practitioner of dentistry is rapidly taking the same place, and this is but a mark of progress in science and public education. The dental profession clings to the old order of things and is reluctant to recognize such progress, but it will come, and in due time it must be accepted. The dental schools must be prepared and their curriculums must be modified in advance of this transition.

We can truly say that the science of orthodontia has attained a high degree of perfection. All agree that orthodontia is most difficult to master, and, in its practice, is most exacting. It requires a broader knowledge and yet a more specific training than students graduating from the regular curriculums of our dental schools have at their command. "The science of orthodontia has certain peculiarities so different from other branches of dentistry and medicine that it is entitled to the proud distinction of being a specialty, and until it is taught and practiced as a specialty it can never fulfill our ideal." (Angle.) Accepting these facts, as we must, it is out of the question to attempt to qualify students for the practice of orthodontia in the undergraduate school. Any dental school which attempts to equip any one for the safe practice of orthodontia by the plan of having the student carry on a few cases in the orthodontia clinic under the direction of an instructor over the period of time allotted for this work is doing a great injustice, to say the least. It is an injustice to the science of orthodontia; it is giving a false impression to the student as to his fitness to undertake the management of malocclusion, and it subjects patients to the possibilities of serious consequences as the result of experimental blunders and mismanagement. I am not prepared to say that the general practitioner of dentistry in small communities at impossible distances from a reputable orthodontist should not undertake the management of simple cases of malocclusion. I do contend that he should at least spend as much

time, if not more time, in his study of the case, making his case analysis, outlining his treatment and retention plan, as well as taking account of the prognosis, as would a well-trained and experienced orthodontist, one who has given much time to intensive postgraduate study and has had the experience of management of such cases in practice. Too often, a dentist not specially trained and not having experience in the management of malocclusion forges into the treatment of a case without adequate thought or study, except the most superficial consideration. Disaster follows in a large percentage of cases undertaken in this way. The old adage that "a smattering of knowledge is a dangerous thing" will ever be true. It is the function of our dental schools, every department in every dental school, and every instructor in every department, to protect every student coming under instruction to the fullest extent possible, that a graduate may not be launched into practice with a smattering of knowledge in any part of the progression in which he is supposed to be well trained. The greatest curse on the history being written today by the dental profession is the institution known as the dental laboratory, which has its greatest influence on the practice of prosthetics. Much of the sadness written into the history of the sick human being is traceable to the prosthetic piece made on a model only the impression of which was taken by the licensed practitioner of dentistry. Literally bushels of pieces are continuously being made entirely by technicians in a dental laboratory, usually according to their own ideas, without any knowledge of the patients who are to wear them. Likewise, the so-called specialist within the institution of the dental laboratory constructs orthodontic appliances on a model provided by the dentist according to his (the technician's) own ideas, without ever seeing the patient who is to wear this appliance, and having no knowledge of conditions as they exist with the individual case. He then promises success with the use of such appliance if the instructions given are followed. This is the greatest curse on the science of orthodontia today. The criticism regarding this condition does not rest so much with the operators of dental laboratories as they have no professional or ethical conscience or responsibility. It is the dentist who employs them that bears the responsibility and who must face the disaster to patients who suffer from such practice. The dental laboratory, I believe, has its place and a function to perform in carrying out the instructions of the dentist as to the type, form and character of the prosthetic piece to be constructed, and in doing the so-called drudgery of vulcanizing, cleaning, soldering, polishing and the like, but to supplant the knowledge, education and training in fundamental principles of dentistry as taught in dental schools is disastrous, and the dentist who allows this condition to exist, is to be severely criticized. The orthodontic laboratory is of course an outgrowth of this same condition and has no place or excuse in the practice of orthodontia. The construction of an orthodontic appliance, the application and management of such appliances, diverts the attention of the student from the real purpose of the clinic. The time may be spent more profitably to the student and his future patients by studying the development of the denture, the causes of its deviation from the normal and the question as to when interference should be undertaken. It is true that every department of dentistry is concerned with a program of prevention—the prevention of progress of the trouble, be that what it may—but it is chiefly a reparatory program. No place in the dental curriculum is the development of occlusion studied more carefully than in the orthodontic clinic. No time in the life of the denture can so much be done by careful and proper management to prevent a developing malocclusion and its sequelae than during the normal period of growth. Here, then is the greatest opportunity for the training of students in prevention as the paramount thought is growth—normal growth—rather than repair.

It is my belief that an orthodontic clinic, to perform its chief function in the undergraduate dental curriculum, must use the clinical material presented to exemplify the principles taught in the lecture course in orthodontia of such fundamentals as occlusion, and correlate the teachings in the science of anatomy, physiology, histology, embryology and the like, making the practical application on the growing boy and girl. To exemplify the causes of malocclusion, particularly the simple and frequent cause which any dentist should know and should be able to recognize, he should be able to act intelligently in removing the cause and give

the natural forces of growth a chance to progress unhampered. Only such corrective treatment should be given in the orthodontia clinic, and by the clinical staff, as is required to carry out this principle of prevention and to reestablish normal forces. I do not believe that a student so trained will be launched in practice with any wild ideas as to his ability in the management of malocclusion, nor will he increase the activities of the orthodontic laboratories. If the student has become sufficiently interested in the type of practice found in orthodontia, he has seen enough to know that he is not prepared for its practice. He will want to know more—he will want to have proper training, and he will therefore be stimulated to take such special training where a more intensive course of instruction is given, where he may obtain clinical and technical experience. The graduates so trained will make better orthodontists, and orthodontia will continue on its progress to a higher plane, with mutual benefit to the profession and to the public.

REPORT OF THE WORK OF THE EDUCATIONAL COUNCIL*

By S. W. FOSTER, D.D.S., Atlanta, Ga.

I HAVE been requested to give to this body a report of the activities of the Dental Educational Council during the past years.

It appears to me that a detailed report would be but a repetition of what has previously been published, as the Council's most able secretary, Albert L. Midgley, has presented a complete annual report for your general information. However, since this organization is more immediately and vitally interested in the problems of dental education than any other body, it may be deemed appropriate to refresh your memories by reviewing some of the high lights on the Council contributions toward the progress of dental education.

As you know, the Dental Educational Council of America was created at Old Point Comfort, in 1909, by the appointment of five members each from the National Board of Dental Examiners and the National Association of Dental Faculties. In 1910, the National Dental Association was asked to appoint five members. Thus, the Council functioned with fifteen members until 1921, at which time the number was increased to twenty-four. In 1923, it was reduced to eighteen and, in 1927, at Detroit, it was again reduced to fifteen members, five from each of the parent organizations, as originally constituted.

FINANCES

Since 1923, the Council has been financed by the American Dental Association. In 1925, on a resolution of the House of Delegates, the members of the Council, representing the American Dental Association, were officially constituted a subcommittee of the Committee on Dental Education of the American Dental Association. This official recognition placed the Council in a position to submit its budget just as other standing committees do; the budget, when

*Read at the General Session of the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 27, 1929.

approved by the Board of Trustees and confirmed by the House of Delegates, becoming at once available to the Council. The amounts voted to this account have ranged from $5,000 to $10,000 annually.

Previous to 1923, the greater part of the Council's expense was borne by a majority of colleges now members of this Association. You recall the time when schools were assessed 50 cents per student.

It is no doubt pleasing to know that this situation has been relieved.

The Trustees of the American Dental Association feel that the Dental Educational Council of America as a committee is a vital force in the advancement of dental education, and we are happy to report that, on recommendation of the Trustees, our parent organization has seen fit to assume the responsibility of financing it as it does other standing committees.

The first classification of schools of the United States was tentatively made in 1918. At that time, there were forty-eight schools.

You vividly recall the visions we had of endowments when the survey of dental education and inspection of the dental colleges of the United States and Canada were made in 1921-1922 by the Carnegie Foundation, under the leadership of William J. Gies, assisted by members of the Council.

This inspection furnished a basis for a more complete classification, which was made in 1923.

In this classification, the Council adopted a point system divided into ten main groups, each of which has a value of ten points, as follows:

1. Location and building.
2. Organization and administration.
3. Finances.
4. Faculty and teaching staff.
5. Entrance requirements and advanced standing.
6. Curriculum and course of study.
7. Academic and medicodental subjects.
8. Dental technology.
9. Clinical dentistry.
10. State board record.

An average of the combined grades given the school on these items by all members of the Council reflects its rating. A committee has been appointed to revise this system for future use.

In 1927, the Carnegie Foundation issued its final report and summary of the status of dental education in America.

This unquestionably is one of the most valuable contributions ever made to dental literature.

The Council, in all of its deliberations (notwithstanding opinions to the contrary) has had an earnest desire to render a constructive and not a destructive service. It holds no brief against those pioneer privately owned schools of past years. They all did their bit and in the main are to be commended for their sacrifices and achievements.

The Council, however, recognizes that the day of the privately owned dental school has passed, that advanced dental education demands a broader educational concept and that no school can meet the requirements of modern education which is conducted for profit.

Through its advice and cooperation, schools have been consolidated (a few discontinued) until we now have in the United States only thirty-eight class A and B schools. None is privately owned or conducted for profit. All of them are operated under an eleemosynary charter.

There are two unclassified schools, the class C having been discontinued.

The Council has published several books detailing rules and regulations recommended for the governing of colleges. The last of these was published in 1927, copies of which were placed in the hands of each school.

At no time during the history of dental education has there been such agitation pertaining to a dental curriculum as has existed during the past six years.

There have been numerous plans suggested, most conspicuous of which are what is known as the one-four plan, the two-three-graduate plan and the two-four plan.

While the Council at that time held no prejudice against those schools which would attempt to conduct either the two-three or the two-four plan, they officially supported the one-four plan, and they adopted a rule requiring that all schools of A or B rating must advance to one year of predental work, beginning with the college year of 1926-1927.

In 1926, the following resolution was adopted by the Council:

> **Preprofessional education given either by a dental faculty in a dental school or not mainly under the auspices of the academic college does not meet the minimum requirement in the sense in which the Council now expects this standard to be enforced. After the close of the 1927-1928 academic year, a school conducting such a first year curriculum will not be eligible for a Class A or Class B rating.**

Happily, the deans of colleges have almost without exception cooperated with the Council in its endeavors to make an impartial survey.

It is to be regretted that a few of our most cherished and honored schools have felt that, for financial and other reasons, they could not meet the advanced requirements, and consequently, have elected to close their doors. Some of these we feel have made a splendid contribution to dentistry and we regard their closing as a distinct loss. Among those, we might pause to mention, are the Vanderbilt, of Nashville, Tulane, of New Orleans and the Ohio Dental, Cincinnati. This briefly covers some of the outstanding achievements of the Council during the past six years.

The task of inspecting and classifying the schools of the United States has been long and tedious, but I am convinced that it has been worth while.

It seems to me that, in the immediate future, the work of the Council should be more of an advisory character than otherwise. Schools have been reorganized. All are on an eleemosynary basis and are doing good work. I recognize the fact that some members of the Council feel that *all* schools should be inspected approximately every five years.

I speak conscientiously from the experience of years and from observations made in this field, when I say to you that the disturbing influence coincident with the reinspection of schools within the next few years will, in my judgment, do far more injury than good to the cause of dentistry, except when inspection is requested by the college.

A HISTOPATHOLOGIC STUDY OF IMPACTED TEETH*

By HAROLD G. WORMAN, D.D.S., Minneapolis, Minn.

GOOD fortune has supplied us with material from the jaws of a dog from which we have been able to make a study regarding what may happen to impacted teeth. A perusal of the literature discloses the fact that similar studies have been made. Our case, with the presence of many impacted teeth and the peculiar appearance of the few erupted teeth, is, we feel, especially interesting.

The first investigator to describe the histopathologic changes in impacted teeth, together with the surrounding tissues, was E. Kotanyi.[1] His investigation covers two impacted cuspids and two third molars from human jaws. The most interesting feature in Kotanyi's work from our point of view is the fact that the epithelium covering the surface of the enamel was destroyed in several places, especially in the case of one of the molars, and in these places cementum was deposited.

It is known that the outer surface of the enamel of tooth germs is covered with epithelium. This epithelium, early in the development of the tooth, consists of the well-known four layers; i.e., outer enamel epithelium, stellate reticulum, stratum intermedium, and a ganoblastic (ameloblastic) layer. In the later stages of development, the cells of these four layers of specialized epithelium gradually revert back in type to the squamous epithelium lining the buccal cavity, from which they came. The whole epithelial covering of the enamel is, just before eruption, reduced to only a few cells in thickness. This reduced enamel epithelium covers the entire surface of the enamel until the tip of the cusp breaks through the mucous membrane of the mouth. It is supposed that the enamel epithelium protects the enamel from being attacked by the connective tissue, which would resorb it or build bone or cementum on it.

A similar study was undertaken by W. Bauer,[2] with corresponding results. In Bauer's case, inflammatory processes were noticeable, and it is to be supposed that these inflammatory conditions were the cause of the destruction of the enamel epithelium of the impacted teeth. Thus, the resorption of the enamel and subsequent deposition of bone by connective tissue was made possible.

The case described here features so many things of interest from the point of view of the biology of the teeth that we feel it proper to present it.

Macroscopically, the absence of many teeth and the peculiar shape and color of

*From the Research Department (Director, Balint Orban) of the Chicago College of Dental Surgery, Dental Department of Loyola University.

1. Kotanyi, E.: Histologische Befunde an retinierten Zähnen, Ztschr. f. Stomatol., Vol. 22, 1924.

2. Bauer, W.: Ergebn. d. ges. Zahnheilk., 4:1.

the erupted teeth were of interest. Of the erupted teeth not one could be considered to be normally erupted, only the tips of the cusps being exposed. The surface of the enamel was rough and showed brownish mottling. The deep gingival crevices and inflamed gums noted at several places were striking. One of the erupted cusps was only loosely attached to the surrounding tissue, and was freely movable.

The whole of each jaw was sectioned in series. A microscopic study was made of this series of sections, and photomicrographs were selected from the total number taken to illustrate the conditions found.

Figure 1 shows a section from the lower jaw in the region of the cuspid. At the extreme left is seen one incisor, in the upper right corner a bicuspid, and the permanent cuspid is seen impacted in the jaw. Two other teeth, probably an incisor and a bicuspid, are also seen to be impacted. In this figure, our attention is called at once to the fact that the root portion of the teeth, especially in the cases of the bicuspid and the impacted cuspid, is not formed. The peculiar finding was present in the case of all teeth except the incisors, which showed fairly well-developed roots.

In Figure 2, we see the labiolingual view of one of the bicuspids. The attained length of the root is represented by the vertical distance between *a*, the cemento-enamel junction, and *b*, the malformed apex. This partially developed root is covered by primary cementum, and about the apical region some cementum of the secondary type may be seen. A few narrow openings in the tooth structure contain the blood vessels, lymph vessels and nerves passing from the periodontal membrane to the pulp. The whole series of sections of this tooth do not show more extensive root formation than we see here.

Fig. 1.—Section from lower cuspid region of dog. At the extreme left is seen one incisor, and a bicuspid is at the upper right. The permanent cuspid is impacted in the jaw beneath what seems to be an incisor and a bicuspid, also both impacted. (All sections from the same dog.)

One of the erupted molars is seen in Figure 3. Only the tip of the cusp is elevated above the level of the gum. The pulp (*a*) appears normal. A regular row of odontoblasts line the pulp chamber. At *b*, we observe the indication of a root and root canal. At *c*, the pulp chamber communicates, through a wide opening, with the periodontal membrane. At *d* and *e*, deep resorption eliminates the tooth substance, the enamel at *d* having been partly destroyed. The tissue in this area simulates granulation tissue in character. The gum margin on both sides is inflamed.

We see in Figure 4 the section of two teeth in the upper jaw. One (*a*), near the surface of the bone, shows resorption lacunae along its most superficial part, such as we see along the outer margin of the bone. Above the resorbed surface of this tooth, the subepithelial connective

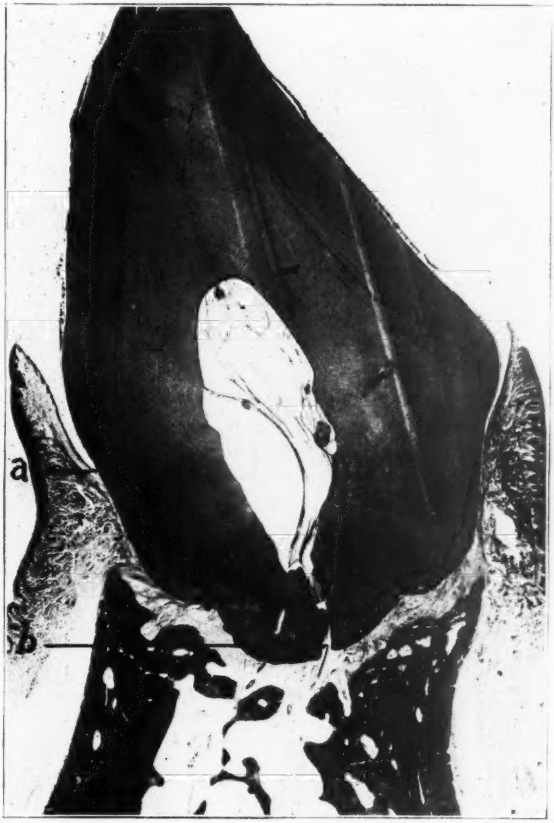


Fig. 2.—Labiolingual view of one of the bicuspids. *a*, cemento-enamel junction. *b*, malformed apex.

tissue, as well as the surface epithelium, shows signs of an inflammatory reaction which has more or less subsided. The epithelial layer is wide and has more finger-like projections than elsewhere, and the connective tissue appears scar-like. It may be supposed that the cusp of this tooth was at one time erupted, but came to be resorbed by the connective tissue. Everywhere in the tooth substance, resorption areas are seen in connection with the connective tissue of the periodontal membrane. Similar areas may have separated the erupted cusp from the rest of the tooth, and later exfoliation probably took place as a result of an inflammation about the cusp, which, after separation, acted as a foreign body. Presumably, after the loss of the separated cusp, the inflammation subsided and the scarring that we see in Figure 4 resulted. No root whatever has developed in this tooth or the other impacted tooth (*b*) in this picture. This tooth (*b*) is embedded deeper in the jaw, being completely surrounded by bone. Deep resorption has so nearly destroyed the tooth structure that the original shape of the tooth is recognized with difficulty.

That the foregoing explanation of the scar and the resorption of the missing cusp has a basis will be readily recognized when Figure 5 is studied. This picture shows an extensively destroyed and hardly recognizable tooth. At *a*, we see that the cusp of the tooth is exposed in the mouth, protruding above the extensively inflamed gum margin (*b*). This piece of cusp is joined to the underlying connective tissue over a small area at *c*. Here, we see signs of acute inflammation. By studying the relative positions and out-

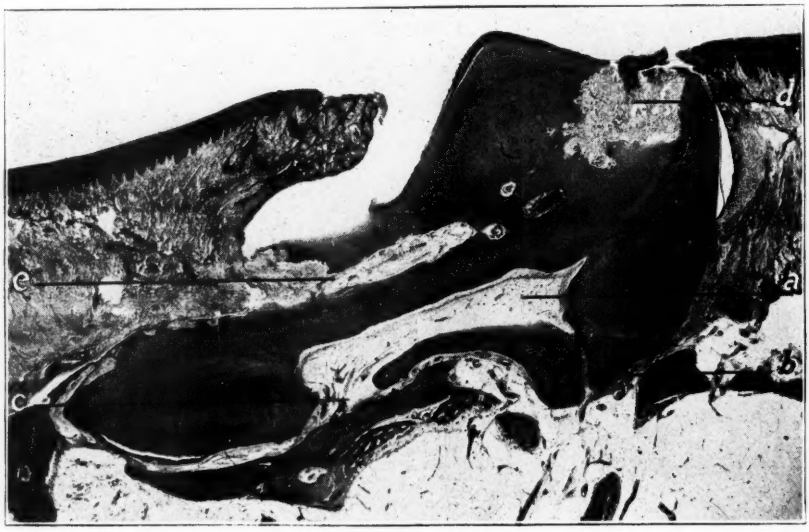


Fig. 3.—Erupted molar. *a*, normal pulp. *b*, indication of root canal. *c*, opening from pulp chamber to periodontal membrane. *d* and *e*, deep resorption. Enamel as well as dentin is resorbed at *d*.

lines of the superficial piece of cusp and the tooth structures present deeper in the tissues, one can be sure that the cusp in question was once an integral part of a tooth, now so nearly resorbed in its entirety. At *d*, we observe pulp tissue of fairly normal appearance surrounded by dentin. Deep resorption has destroyed the tooth substance, and, in many places, bone has been laid down on the dentin. The time was not far distant when the cusp (*a*) would have been exfoliated, and we can reasonably suppose resultant conditions would have simulated those seen in Figure 4 at *a* and *c*.

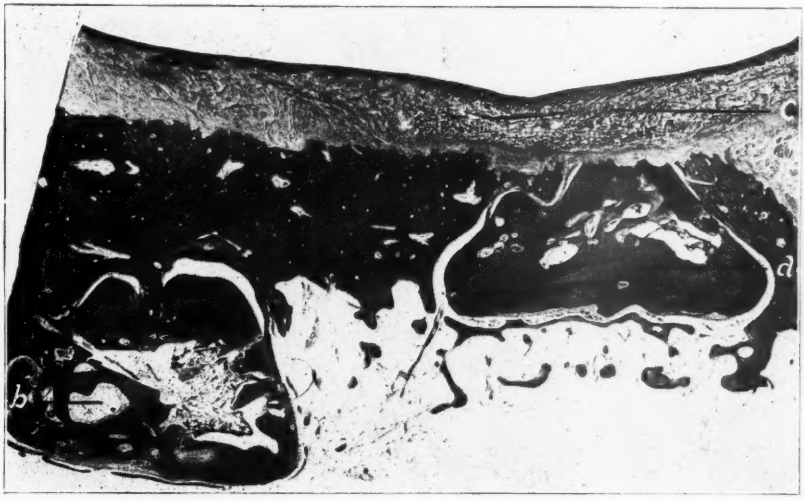


Fig. 4.—*a* and *b*, impacted teeth in upper jaw. One tooth *b* is completely surrounded by bone. *c*, scarlike subepithelial connective tissue.

The foregoing photomicrographs have shown the gross appearance of the various areas in the jaws of the dog under consideration. In the following photomicrographs, we shall discuss more in detail what has happened. Figure 6 shows one of the impacted teeth which is completely surrounded by bone. Resorption is seen, destroying not only the dentin but also the enamel in part.

We may state in general that, in every tooth of this dog, we found large masses of the organic matrix of the enamel; which most probably means poor calcification. Usually, if enamel is decalcified, it entirely disappears, owing to the low content of organic substance. In this special case, more organic substance than normal seems to be present. This could be seen macroscopically, as far as the enamel was mottled and hypoplastic. This poor calcification *may* account for the presence of enamel substance after decalcification.

Resorption of the enamel from outside can take place only after the destruction of the epithelium covering its surface. Throughout the entire series of sections of the jaws of our dog, only traces of enamel epithelium could be found, and the entire surface of the enamel was

partly or entirely resorbed. Active resorption by osteoclasts can be seen in some areas, and a deposition of bone by osteoblasts in others throughout the extent of the enamel surface. In Figure 6, the enamel surface is covered by bone at *a*. Figure 7 is a much higher magnification of the same area. Here, we see a typical arrangement of the enamel rods, giving the effect known as Schreger's lines. The different conditions: At *a*, bone covers the surface of the enamel (*b*); while at *c*, enamel epithelium is present and obviously no resorption of the enamel and no deposition of bone have taken place. Between the areas *a* and *c*, the connective tissue *d* has destroyed the enamel and partly resorbed the dentin (*e*).

The important protective rôle of the enamel epithelium is further emphasized

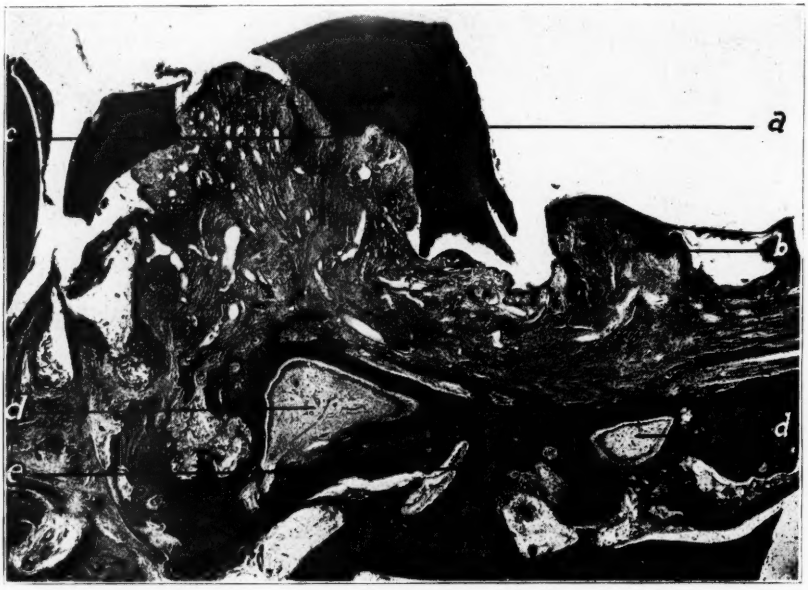


Fig. 5.—*a*, loose cusp of tooth projecting through the mucosa into the mouth. *b*, inflamed gum margin. *c*, connective tissue to which cusp *a* is attached. *d*, pulp tissue surrounded by dentin. *e*, bone.

surface of the enamel which should otherwise be an unbroken, evenly curved plane is here irregularly outlined owing to resorption, and on this irregular surface, bone has been deposited.

Figure 8 is another area from the same section shown in Figure 6. Here, in one and the same specimen, we observe two when we study other similar specimens, such as that shown in Figure 9. At *a*, the enamel epithelium is attached to the enamel. Two long epithelial strands (*b*) project into the periodontal tissues separated from the surface of the enamel by connective tissue. At *c*, a point which is only microscopically removed from *a*,

but at which, nevertheless, the enamel surface is unprotected by epithelium, we see resorption and deposition of bone.

From these findings regarding the relationship between enamel epithelium and resorption of the enamel, with later deposition of bone or cementum, we can confirm the opinion of the former investigators. Regarding the cause of the destruction of the enamel epithelium, we cannot offer a definite explanation. We must consider inflammatory processes which may have occurred earlier in the life of the dog. This especially must be taken into consideration in the instances in which the teeth are lying just beneath the mucous membrane. But this supposition is less tenable as regards those teeth lying deeper in the jaws.

In our case, we must take another fact into account; namely, the absence of root formation in most of the teeth. We know that, for the formation of dentin, and so for the formation of the root, the presence of epithelium is necessary. Epithelium, the so-called "Hertwig's epithelial sheath," probably stimulates the pulp tissue to form dentin. It may be supposed that, in the case of this dog, some kind of general disturbance led to the destruction of the epithelium around the teeth and that this destruction may have attacked the epithelium on the surface of the enamel as well as Hertwig's sheath, lack of formation of the roots and resorption of the enamel resulting, with subsequent deposition of bone. This is an attempt to explain a process of which

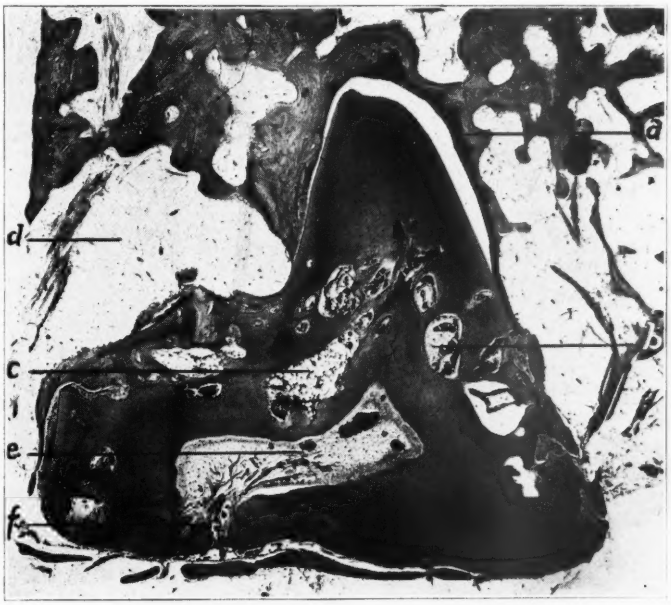


Fig. 6.—*a*, bone laid down on partly resorbed surface of enamel. *b*, connective tissue in resorption lacunae of the dentin. *c*, bone marrow in resorption lacunae. *d*, connective tissue. *e*, pulp tissue. *f*, attempt at formation of apical foramen.

we see only the result. An apparent gap in the reasoning here attempted lies in the fact that the apical foramen, wherever it is with respect to the length of the normal tooth, is not a wide open canal as one might expect in such a disturbance of development, but rather a narrow aperture similar to the foramen found normally in dog's teeth. In Figures 2, 3 and 6, as well as through the specimens studied, we may see that the dentin in the apical region is not normal in quality or appearance. A higher magnification, Figure 10, shows this dentin to be irregularly built, with enclosures of cells and possibly poor calcification. These areas of poor dentin are located in general around the apical region, but extend as well toward the crown to various heights. However, in the crown portion, they are never so extensive as about the apex, and this poor dentin does not reach the cementum on the one side or the pulp on the other. In the apical region, in some instances, the dentin is of uniformly poor quality throughout its entire thickness. The presence of this poor dentin, especially in the apical region, may be an in-

Fig. 7.—Higher magnification of *a* in Figure 6. Deposit of bone *b* on the irregular surface of the resorbed enamel *a*.

dication of the general disturbance to which we referred as being a possible cause of the destruction of the epithelial tissues of the tooth germs.

Another interesting feature of this specimen is the relation of resorption of the dentin to the pulp chamber. We can see in Figure 5 at *d* and in Figure 6 at *e* that, in spite of the extensiveness of the resorption of the dentin, the pulp is not approached throughout the entire series of sections, except in one instance. This instance is shown in Figure 11 at *a*. At *b*, we see the pulp tissue with somewhat dilated blood vessels. The layer of odontoblasts is seen at *c*; the dentin surrounding

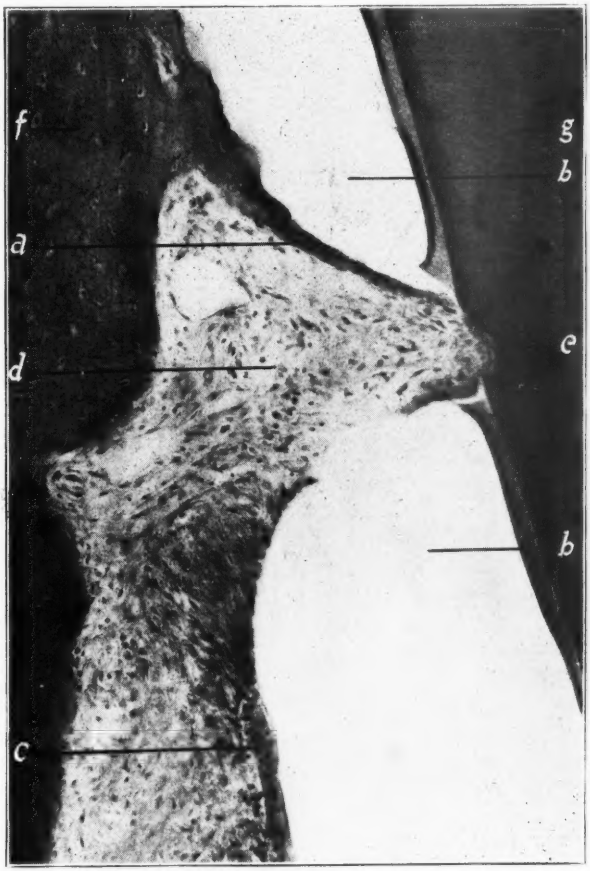


Fig. 8.—Another area from the section shown in Figure 6. *a*, bone on the surface of the enamel. *b*, space from which enamel has been decalcified. *c*, enamel epithelium. *d*, connective tissue. *e*, resorption lacunae in the dentin. *f*, bone. *g*, dentin.

the pulp, at *d*. At *e*, there is deposition of bone on the surface of the dentin. At *f* is a marrow space filled with fatty tissue; at *g*, the poorly developed dentin near the apical opening. A higher magnification of *a* is shown in Figure 12. The pulp tissue contains dilated blood vessels. The channel *a* which leads from the pulp to the marrow space (*c*) is lined on both sides by bone which has been

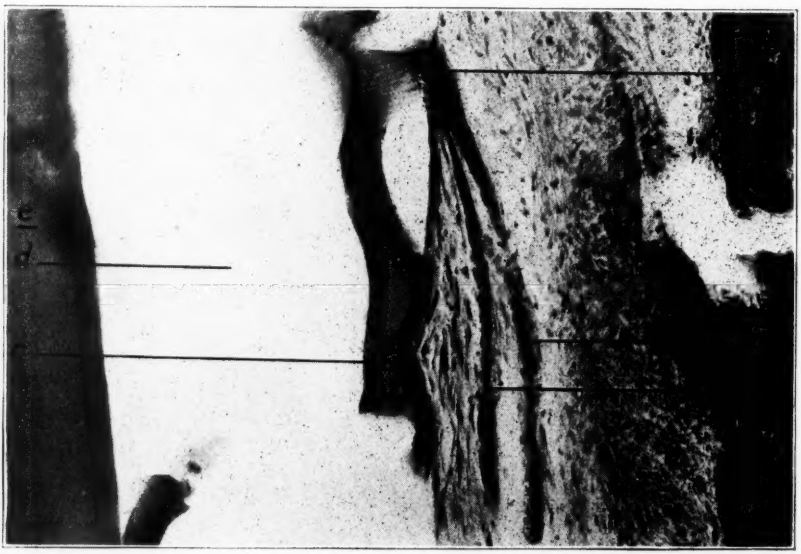


Fig. 9.—*a*, enamel epithelium. *b*, epithelial strands projecting into periodontal tissues. *c*, bone deposited over resorption area on enamel surface. *d*, space from which enamel has been decalcified. *e*, dentin.

deposited on the resorbed surface of the dentin.

Figure 13 is a vivid example of the relationship between the pulp and the resorption process. The pulp in the center is surrounded by dentin, and resorption lacunae are scattered around this. The cause of this behavior of the resorption process toward the pulp may find its explanation in a supposition of Gottlieb[3]; namely, that resorption of hard substances, such as bone, dentin and cementum, depends not only on outside influences, such as inflammation and pressure, but to a certain extent also on the quality of these hard substances. Under quality, we may consider as a factor the grade or degree of calcification; i.e., the better the calcification, the greater the possibility of resorption. This supposition of Gottlieb has been proved in a study made by

3. Gottlieb, Bernhard: Paradental Pyorrhoe und Alveolaratrophie, Fortschr. d. Zahnheilk., 3 (May) 1927. Orban, Balint: Dental Histology and Embryology, Ed. 2, Philadelphia: P. Blakiston and Son, 1929.

Rudolf Kronfeld.[4] Thus, in the case of our dog, it is probable not only that the dentin lying nearest the pulp was the last dentin produced by the pulp, and hence not so well calcified as older dentin, but also that the calcification grade was subnormal for the particular stage of development and age of the dog.

In Figure 14, a higher magnification of an area in the dentin of one of the impacted teeth is shown, with baylike excavations. The tissue filling these resorption lacunae is a highly cellular hyperemic connective tissue. In this picture, active resorption by osteoclasts on one side and deposition of bone on the other are seen to occur simultaneously.

Fig. 10.—High magnification of section showing irregularly built dentin, enclosure of cells, resorption of cementum and possibly poor calcification.

4. Kronfeld, Rudolf: Spielt die Qualität der Hartsulestauzen bei der Resorption eine Rolle? Ztschr. f. Stomatol., 25 (Nov.) 1927.

Our material confirms, then, the conclusions of former investigators regarding what may take place in connection with impacted and unerupted teeth; namely, (1) that inflammations due probably to reactions from a foreign body or obscure interference with metabolic or developmental processes in general may destroy tissues locally which are indispensable to the normal development and eruption of the teeth; (2) that contact of connective tissue with calcified tissues may cause resorption of the latter; (3) that resorption occurs more easily where the degree of calcification is highest; (4) that once the cause of such resorption is removed,

Fig. 11.—*a*, resorption reaching into pulp. *b*, pulp tissue. *c*, layer of odontoblasts. *d*, dentin. *e*, bone. *f*, bone marrow in resorption area. *g*, poor dentin.

or has run its course, bone may be deposited on the resorbed surfaces by the same tissues which were responsible for the resorption; (5) that epithelium protects the enamel of the tooth from the action of connective tissue during development and eruption; (6) that the presence of epithelium is necessary for the development of dentin and that, if this epithelium is injured or destroyed, only an abnormal root, if any, will develop.

Fig. 12.—Higher magnification of Figure 11 *(a)*. *a*, connective tissue in resorption area reaching into pulp. *b*, pulp tissue. *c*, bone marrow in resorption area.

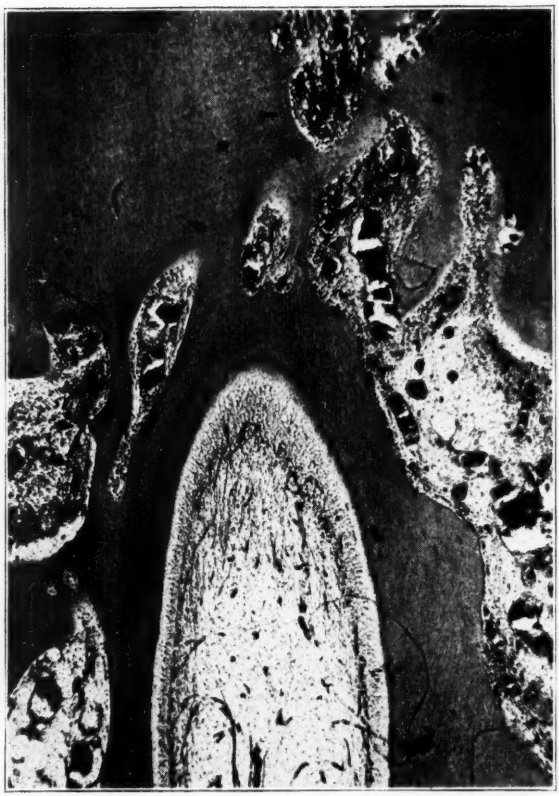


Fig. 13.—Numerous resorption lacunae in the dentin everywhere approximately equidistant from the pulp.

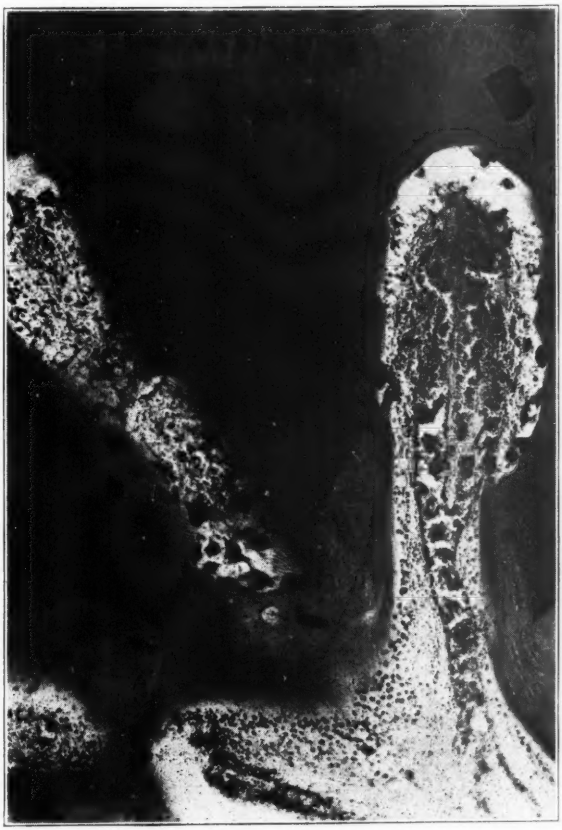


Fig. 14.—Higher magnification of Figure 13, showing active resorption by osteoclasts on one side and deposition of bone on the other, occurring simultaneously.

CONTROL OF DECALCIFICATION OF ENAMEL AND OF DENTAL CARIES WITH SPECIAL REFERENCE TO THE LABIAL SURFACES OF THE ANTERIOR TEETH*

By WILLIAM DWIGHT TRACY, D.D.S., New York City

HOW beautiful are the dental structures and the gum tissue when normal, with the unbroken gleaming surfaces of the enamel, and the firm well-nourished gingival tissue, and what a picture they afford when viewed through magnifying binoculars. If we could instil in the minds of dental students the desire to cultivate their powers of observation in the study of normality wherever opportunity presents, there would be built up in their inner consciousness a reverence for the tissues with which they are to deal. It would enable them to detect in their incipiency those departures from the normal which, if neglected, so frequently result in serious pathologic conditions.

Early treatment of these slight initial lesions, and discovery and correction of the conditions which are responsible for their incidence, will usually prevent serious involvement of the soft tissues or extensive loss of tooth structure. On the other hand, if they are neglected through lack of careful observation and early recognition on the part of the operator, they may easily run into chronic gingival disturbance and devastating caries of the tooth structure, the results of which we can view with nothing but regret.

Even when we do all that we can in the way of prevention by careful observation, early treatment, hygienic advice and periodical examination, it is a running fight to keep up with the untoward tendencies that seem to prevail in the mouths of many patients. Therefore, the precautions just mentioned must be regarded as fundamental in the control of decalcification of enamel and of dental caries.

Conditions of the labial surfaces are perhaps as easy to observe and to control as any in the entire denture, and yet how frequently are these surfaces involved.

The idea of prevention is now dominant in the minds of all, not only among those who are engaged in "health service," that splendid and comprehensive term introduced by Prof. William J. Gies, but by the laity themselves, who are rapidly awakening to a realization of the fact that prevention is better than cure. So dominant is this thought that the oft quoted saying, "To cure is the voice of the past: to prevent is the divine whisper of the future," might well be paraphrased to read "to cure was the voice of the past; to prevent is the energetic voice of the present."

But even in a well regulated practice where every possibility of preventive dentistry is applied and a child is brought to the age of 14 or 15 years with a clean wholesome mouth and a minimum number of fillings, changes in the life routine

*Read before the Section on Preventive and Operative Dentistry at the Better Dentistry Meeting of the First District Dental Society of New York, Dec. 5, 1928.

of the patient occur which often prevent regular, systematic and orderly dental care. Boarding schools and colleges intervene and, in spite of all admonitions and instructions, long periods pass without examination and prophylactic treatment, and, in some instances, these patients are guilty of inexcusable laxity in their personal care of the mouth.

When such a patient is next seen by the dentist, the picture has changed. The beauty and perfection of normality have fled. The gingival tissues are red, congested and flabby. The necks of the teeth are seen to be discolored and the enamel has lost its luster. The dentist is naturally disturbed and disappointed. He submits the patient to a thorough prophylactic treatment, making sure that any deposits of serumnal calculus lurking under the gingival margins are removed. He not only again instructs the patient as to the necessity of faithful personal care, but also demonstrates the technic of proper cleaning and gum stimulation so that the soft tissues may be brought back to a physiologic condition as nearly as possible.

The teeth are now examined with magnifying binoculars, and frequently the early evidences of decalcification may be seen. An intelligent effort to polish out these spots is made, with fine stones and disks, Arkansas points, and a final finish with tin oxid. This, in slight lesions, will restore to the enamel a lustrous surface; and I think it may be safely assumed that if surfaces treated in this manner have proper subsequent care, they will retain their integrity, but if they are neglected, they will ultimately succumb to the destructive influences that cause decalcification.

In older patients, when recession of the gum has permitted the neck of the tooth to become exposed and the early stages of disintegration are discovered, it is advisable, after the polishing is completed, to use solution of formaldehyd U.S.P. in a 40 per cent dilution as a topical application on the exposed neck. This may cause a brief painful reaction, but reduces the possibility of subsequent sensitiveness and has a salutary influence on the exposed surface. On lower anterior teeth, where the necks of the teeth are not visible to the casual observer, such exposed areas may be treated with silver nitrate solution, 50 per cent, which causes some discoloration, but which also has a protective influence lasting for some months.

As a means of minimizing the *Bacillus acidolphilus* content in the mouth by the periodical use of metaphen and hexyl resorcinal, and thus reducing the tendency to caries of the teeth, the experiments of Professor Bunting of Ann Arbor should be mentioned, as they give promise of being helpful in meeting this problem. But until the work has been carried farther, it is unlikely that it will be adopted as a preventive measure by any large number of general practitioners.

Another interruption of the so-called well-controlled practice occurs when the patient whom you have watched grow to maturity becomes an expectant mother. All precautions are stressed up to a month or two before confinement, but then comes the trying period of lactation and the increased responsibilities and illnesses that so frequently occur, and which so commonly break in on the scheduled dental treatments.

What can we do other than to emphasize the necessity for even greater personal care of the oral cavity, more earnest attention to maintaining a normal diet with its fresh vegetables, salads, fresh fruit, whole milk and whole grain foods? The diet, of course, is to be prescribed

and directed by the physician in charge of the case and his cooperation secured and his interest elicited so that the patient may return for prophylaxis and dental care at the first opportunity.

Where decalcification of the enamel has progressed to an extent which makes it impracticable to polish out the defect successfully, a filling is indicated, and this should be dealt with according to the best judgment of the operator.

For esthetic reasons, most of us, even though partial to the use of gold foil in many locations, refrain from filling labial cavities with this material. The choice then lies between some one of the silicate cements and a porcelain inlay. In any cavity on the upper anterior teeth, the upper edge of which actually lies under the free margin of the gum, a porcelain inlay is indicated. This opinion is based on the fact that the gum takes much more kindly to a well fitted porcelain inlay in this location than it does to the granular surface of the most carefully inserted silicate filling.

Still another factor in favor of the porcelain inlay in these locations is that, with it, we have the possibility of restoring and maintaining gum tension, which is so necessary to the welfare and health of this tissue. Even though a silicate cement filling should be nicely contoured and finished with a view to restoring this relation of tooth surface to the overlying gum, it would in a few months lose its smoothness, and that contour so carefully arranged would be lost through the wasting process that seems to take place with all fillings of this type. I heard a prominent periodontist say some time ago that he wished the silicate cements had never been introduced as he felt that they had done more harm than good, and when used in cervical cavities the margins of which lay under the free margin of the gum, he regarded them as a positive menace. This may in part be due to the abuses to which the material has undoubtedly been submitted by the profession, but it indicates the impression created in the mind of a careful observer.

If the upper margin of the prepared cavity lies below the gum margin, this element of irritation to the soft tissues is eliminated, and the silicate filling may be used. The silicate cements have a field of usefulness in our work and we cannot do without them, but our disappointments with this material have been so numerous and so persistent that it should be used with the utmost conservatism.

OCCLUSAL CHANGES IN CENTRIC RELATION*

By RUDOLPH L. HANAU, Buffalo, N. Y.

MANY modern scientific researches involve mathematics, physics, engineering and the allied sciences to a greater or less degree. Research in dentistry is no exception, and therefore we also must focus the established findings of other scientific departments to aid in the solution of our problems.

Contemplating the discussion of a prosthetic problem which involves the application of engineering principles, I shall not hesitate to present the purely technical material in technical language, confining the use of current dental nomenclature to the purely dental aspect where it is concise. I believe that it is my privilege to do this in a dentomechanical discussion and that it can be done without beclouding the nontechnical aspect of dentistry. This nontechnical aspect, which involves anatomic, physiologic and related considerations, we grant, is important to the dental practitioner. However, they will be considered as augmentations in this thesis. It is interesting to note that only by a thorough consideration of engineering principles in prosthetic practice can we hope to solve the biomechanical problems of prosthetic dentistry, and that the same conclusions apply to all other branches of denture restoration.

CENTRIC RELATION

It is the main object of this discussion to recapitulate "centric relation," and to distinguish occlusal changes in centric relation from occlusal changes during articulation. It is presupposed that the reader is familiar with the fundamentals[1] of occlusion, jaw relations and articulation, and also with the "realeff"[2] of the tissues.

For good reasons, centric relation was, long ago, chosen as the reference position for registration and diagnosis in denture construction. I have defined centric relation as that position of the mandible in which the condyle heads are resting upon the menisci in the sockets of the glenoid fossae, regardless of the opening of the jaws, and have stated that the relation is either strained or unstrained.

It therefore becomes necessary to select an opening relation and to choose between strained and unstrained centric jaw relation to start with, or as a reference. The opening relation associated with centric relation is usually estimated and accepted after the esthetic and functional requirements have been considered. I have chosen unstrained centric relation associated with an accepted opening for the reference jaw relation, and I am willing to assume the responsibility for this choice, because on it hinges the logic and usefulness of the in-

*Read before the Section on Full Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

1. Hanau, R. L.: Articulation Defined, Analyzed and Formulated, J.A.D.A., 13:1694, (Dec.) 1926.

2. Realeff is a term coined by contracting the beginning letters or letter of the words "resilient and like effect" to realeff. It is pronounced rēleff'.

tra-oral registration method that I recommend[3] and also of the conclusions deducted from the figures in the accompanying charts.

Occlusal changes occur in any one particular jaw relation which may be temporary during function and permanent where tissues under the dentures have changed. The point that I wish to emphasize is that such changes in occlusion do not constitute articulation as we ordinarily understand it. Here, I shall give consideration to occlusal changes in centric relation. The effect of tissue changes on occlusion is analogous for other jaw relations.

It will be quite helpful to give a cursory review of the few aspects of articulation bearing on our discussion.

BALANCED ARTICULATION

I define articulation as a change from one occlusal relation into another while the masticatory surfaces remain in contact, i.e., during functional excursions of the mandible. This definition applies to articulation in general and does not specifically infer definite association of occlusion with jaw relations.

While we are about to elaborate on this subject, may it be mentioned that we also conceive an articulation which occurs in function without change of jaw relation proper; namely, when a change from an unstrained to a strained relation, or vice versa, occurs. Such reasoning is responsible for the introduction of the rocking fit or a rocking centric occlusion associated with centric relation, indicated in a previous paper.[4] It also is responsible for the many details contained in the correction technic advocated since 1921.[3] That the correction technic meant a departure from current views was evident from the perplexity which it caused in a clinical demonstration given by me before the National Society of Denture Prosthetists in 1923.[5] Articulation immediately becomes balanced articulation when the continuous array of types of occlusion are balanced. Balanced occlusion in function is achieved only by a rigid application of the dictates of the laws of articulation and skilful execution of the correction technic.[3]

The laws of articulation govern the formation of the masticatory surfaces as definitely as the contents of a cube are determined by its width, depth and height. Figure 3 is introduced to illustrate this truth. It shows occlusal relations of dentures in centric and protrusive relations associated with analogous types of occlusion, which in some of the figures are balanced. For this illustration, I accept four hypothetical mouths identical in every detail, except in condylar indications, which were chosen as follows: minus 30, 0, plus 30 and plus 60 degrees. I then proceeded to build schematic dentures to fit all four hypothetical patients, who are accepted as identical as to centric relation. The masticatory surface outline is shaped to articulate in balance for excursions governed by the condylar indications mentioned before; namely, minus 30, 0, plus 30, plus 60 degrees. Such a scheme permits the insertion of each denture in any one of the hypothetical mouths in any jaw relation. Whereupon, the following effects may be observed:

1. Each denture occludes correctly in centric occlusion associated with centric relation in any mouth.

3. Hanau, R. L.: Articulator Technique for Full Denture Prosthesis, 1928.

4. Hanau, R. L.: Dental Engineering—Dental Prosthesis, Dent. Summary, 45:30 (Jan.) 1925.

5. Proc. Nat. Soc. Denture Prosthetists, 1923.

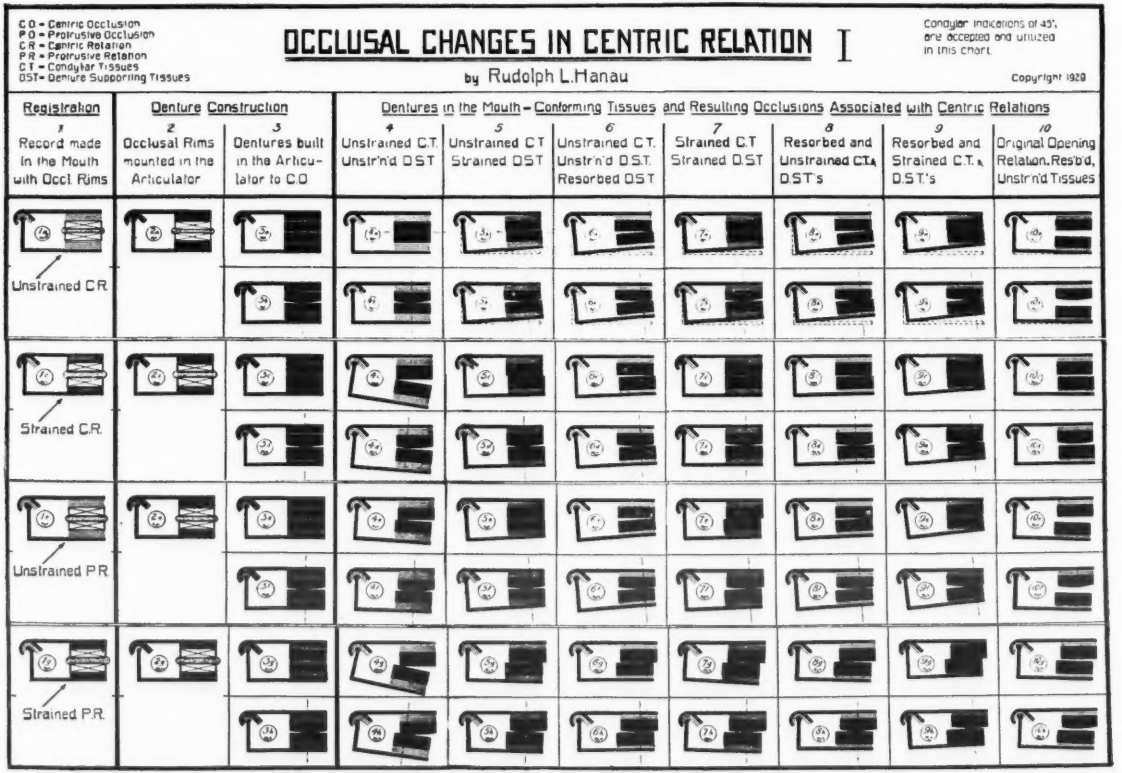

C O = Centric Occlusion
P O = Protrusive Occlusion
C R = Centric Relation
P R = Protrusive Relation
C T = Condylar Tissues
D S T = Denture Supporting Tissues
OCCLUSAL CHANGES IN CENTRIC RELATION I
by Rudolph L. Hanau
Condylar indications of 45°, are accepted and utilized in this chart.
Copyright 1928
Registration
Denture Construction
Dentures in the Mouth – Conforming Tissues and Resulting Occlusions Associated with Centric Relations
1 Record made in the Mouth with Occl. Rims
2 Occlusal Rims mounted in the Articulator
3 Dentures built in the Articulator to C O
4 Unstrained C.T. Unstr'n'd D.S.T.
5 Unstrained C.T. Strained D.S.T.
6 Unstrained C.T. Unstr'n'd D.S.T. Resorbed D.S.T.
7 Strained C.T. Strained D.S.T.
8 Resorbed and Unstrained C.T.s D.S.T.'s
9 Resorbed and Strained C.T.s D.S.T.'s
10 Original Opening Relation. Resb'd. Unstr'n'd Tissues
Unstrained C.R.
Strained C.R.
Unstrained P.R.
Strained P.R.

Fig. 1.

2. A denture also occludes correctly in protruded occlusion associated with protruded relation, provided the condylar indications of the articulator in which it was built are the same as on the patient for which it was built.

3. The masticatory surfaces of a denture interfere in the anterior region, provided the patient's condyle indications are steeper than the condylar indication of the articulator in which the denture was built.

4. The masticatory surfaces of a denture interfere in the posterior region, provided the patient's condyle indications are flatter than the condylar indications of the articulator in which the denture was built.

CAUSES OF OCCLUSAL CHANGES IN CENTRIC RELATION

During the life of a prosthetic denture, complications enter the problem of associating occlusion with jaw relations in the mouth. The entire problem cannot be solved by the skilful technician who simply applies the laws of articulation to the arrangement of the teeth in the articulator, for here one encounters no particular functional complication because of the rigid plaster-of-Paris mounting of the denture bases upon which the teeth are set up. The functional complications of our denture problem really begin with a consideration of "realeff" and changes of the denture bearing tissues, together with an inquiry into the functional relation between the rigid articulator mechanism and the anatomic apparatus.[6]

Prosthetic dentures are made of materials which, for practical purposes, may be considered nonyielding to pressure. Tissues, on the other hand, always yield to pressure, and even change their form in time. For the moment, it is quite immaterial whether such yield or deformation is attributed to displacement, compression or resorption of the tissues, or whether growth has ensued. It is pertinent that tissues change form and are subject to increase or decrease in volume both *in parte* and *in toto,* owing to a positive or negative volume change. Besides, we have to contend with a peculiar effect of an interposed saliva film.

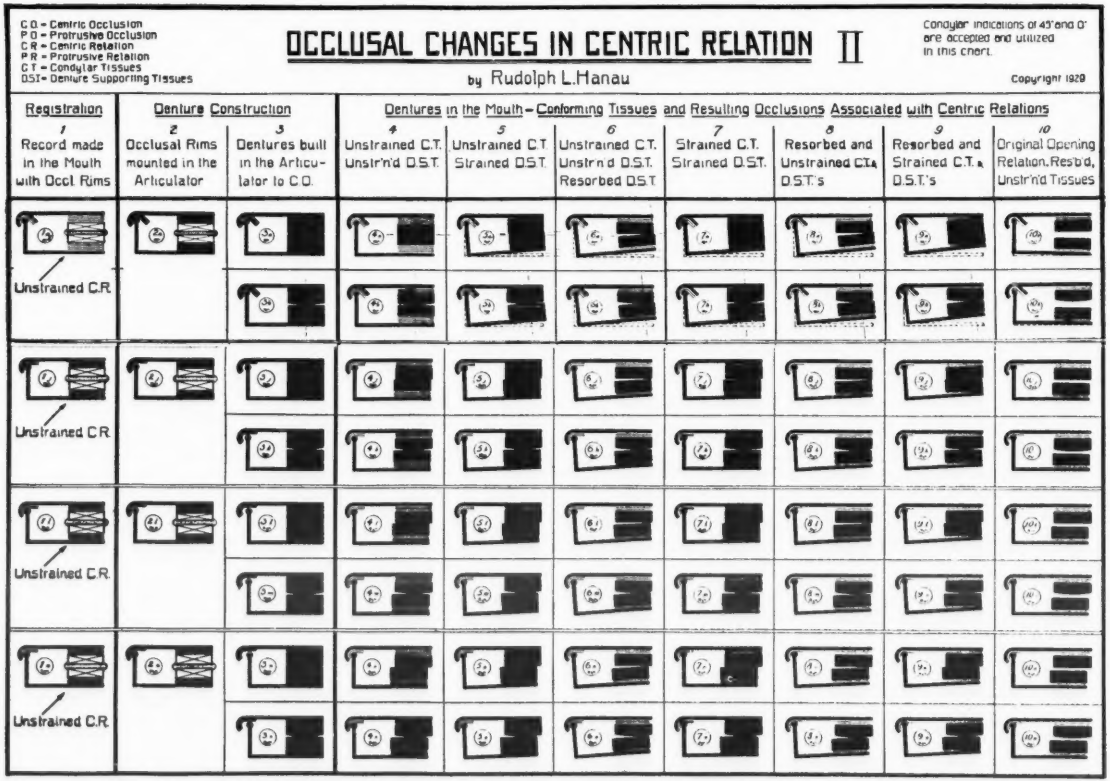
Masticatory muscle tension always causes strained jaw relations. Pressures are transmitted from the jaws directly through the saliva films and the prosthetic dentures in occlusal contact, or indirectly, through an interposed bolus of food.

The positional relations of dentures with regard to their respective jaws in centric relation may change. This change in positional relation of the rigid restorations affects the occlusions. The resulting types of occlusion are of primary interest to us here. Second in order are the underlying causes of these changes.

The changes occurring in consequence of "realeff" are temporary and frequent over a short period of time while those resulting from resorption are gradual and progressive over a long period of time.

The "realeff" (resilient and like effect) of the denture supporting tissues causes a change of positional relation between the restoration and the jaw. It is immaterial to this discussion whether this change of position is due to the fit, the shape or extent of the denture seating surfaces upon the supporting tissue surfaces, the impingement upon tissue areas, the change of tissue conditions, the displacement by pressure of movable tissues in the seating areas, the form of

6. Hanau, R. L.: Relation Between Mechanical and Anatomical Articulation, J. A. D. A., 10:776 (Aug.) 1923.


C.O. = Centric Occlusion
P.O. = Protrusive Occlusion
C.R. = Centric Relation
P.R. = Protrusive Relation
C.T. = Condylar Tissues
D.S.T. = Denture Supporting Tissues
OCCLUSAL CHANGES IN CENTRIC RELATION II
by Rudolph L. Hanau
Condylar indications of 45° and 0° are accepted and utilized in this chart.
Copyright 1928
Registration
Denture Construction
Dentures in the Mouth – Conforming Tissues and Resulting Occlusions Associated with Centric Relations
1 Record made in the Mouth with Occl. Rims
2 Occlusal Rims mounted in the Articulator
3 Dentures built in the Articulator to C.O.
4 Unstrained C.T. Unstr'n'd D.S.T.
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6 Unstrained C.T. Unstr'n'd D.S.T. Resorbed D.S.T.
7 Strained C.T. Strained D.S.T.
8 Resorbed and Unstrained C.T.s D.S.T.'s
9 Resorbed and Strained C.T.s D.S.T.'s
10 Original Opening Relation, Resb'd, Unstr'n'd Tissues
Unstrained C.R.
Unstrained C.R.
Unstrained C.R.
Unstrained C.R.

Fig. 2.

borders and flanges, or the reactions in and about the maxillomandibular joint; or whether the change of position of the dentures is due to other causes. It must be either admitted or denied that a resultant change of relation of the dentures to the supporting osseous structures occurs.

I accept that there are physiologic and pathologic reactions which cause resorption, and also that a change of positional relation of the dentures to the jaws occurs owing to physical causes in the course of ordinary function. The results of this change are directly and indirectly responsible for a new allocation of the restorations upon their respective ridges, which, in turn, causes a change of occlusal relations of the opposed restorations. The unchallenged truths are schematically illustrated in many of the figures in the chart shown in Figure 1.

TISSUES; DENTURES; SALIVA

I shall accept as evidence of tissue growth, an actual or virtual increase of area, height, width or depth of tissues, provided this increases likewise the dimensions of the surfaces of a restoration with which it is in immediate contact.

An actual increase in the size of edentulous ridges due to normal growth of the tissues is hardly to be expected under satisfactory dentures in use.

A virtual increase is often presented by a transposed mandibular ridge in the progress of osseous resorption under ill-fitting malocclucded dentures.

Osseous resorption always takes place in a direction toward the bulk of bone. In the mandible, we find this bulk of the bone near the inferior border in the anterior region; while in the retromolar region, the residual ridge is well surrounded by heavy cortical plates of bone. This being the case, the widths of the mandibular osseous ridge become gradually greater from the last molar region toward the anterior, tipping the remaining anterior portion of the osseous ridge downward. The soft tissues follow. In essence and effect, but not in fact, the mandibular ridge "grew." Such growth we therefore accept as virtual growth.

I shall likewise accept all loss of area, height, width or depth of tissues equivalent to resorption, if such a loss likewise affects the dimensions of those areas of a contemplated restoration which is in immediate contact with the tissues. Later, I shall consider the consequence of resorption, keeping in mind that growth may have an effect opposite to resorption.

Then there is the saliva film, which acts as an indispensable adhesive and seal between tissues and restorations, and, at the same time, permits displacement (not necessarily dislodgment) of the restorations on account of its compressibility and mobility. Cause and effect are in reality reciprocal, for a displacement of the restoration will also cause mobility of the saliva film, and vice versa. The compression effect of the saliva is confined to admixtures of air in the form of bubbles and small accumulations in intended and inadvertent recesses.

During masticatory function, the tissue surfaces in conjunction with the adapted restoration assume the action of a diaphragm pump. This action frequently has a very aggravating effect on stability, especially if enhanced by poor adaptation, leakage at the peripheral borders, lack of border extension and disadvantageous saliva viscosity. The effect of the saliva film mobility and compression is similar to that of tissue displacement and is considered just one more component of the realeff, which, acting temporarily, becomes evident in

temporary displacement or shifting of the restoration on the bearing tissues.

We all know that tissue changes occur, that the progress of tissue changes is more rapid during the period immediately after extraction, that the rate of change gradually decreases but does not stop, that tissue changes are retarded and that tissue conditions are sometimes improved by well-adapted dentures in balanced occlusion.

In the face of the many complications and uncertainties, the solution of the denture problem remains a compromise in which the time element, the tissue endurance, the patient's tolerance and his pocketbook are "flexible" factors,[7] not always accurately predeterminable.

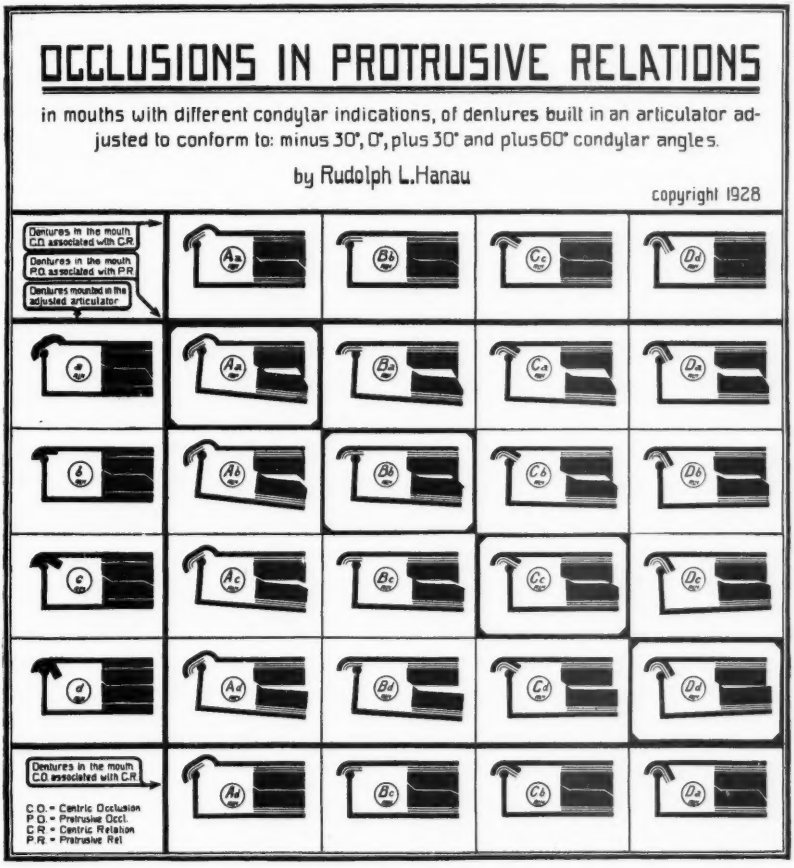
OCCLUSIONS IN PROTRUSIVE RELATIONS
in mouths with different condylar indications, of dentures built in an articulator adjusted to conform to: minus 30°, 0°, plus 30° and plus 60° condylar angles.
by Rudolph L. Hanau
copyright 1928
Dentures in the mouth C.O. associated with C.R.
Dentures in the mouth P.O. associated with P.R.
Dentures mounted in the adjusted articulator
C.O. = Centric Occlusion
P.O. = Protrusive Occl.
C.R. = Centric Relation
P.R. = Protrusive Rel.

Fig. 3.

The time element is a flexible factor

7. Hanau, R. L.: Application of Engineering to Dentistry (unpublished data).

with many soothing and acerbating components. Tissue endurance is limited. The patient's tolerance is a matter of speculation, the outcome of which depends to a great extent on the good will of the patient and the skill of the dentist. A discussion of these items would lead us too far away from the main issue. Just a few remarks on the patient's pocketbook, because that factor is often circumnavigated.

Many patients allow financial consideration to stand between them and comfortable denture service and endure dentures even when they are wholly unserviceable. Whenever a patient is more interested in his health than in his money, the problem becomes quite simple for a skilful prosthetist. A properly rendered denture service, it is understood, exalts construction and treatment above salesmanship and implies an appropriate remuneration. Denture service, as we understand it, means an excellent prosthetic appliance to start with, and readjustment and overhauling of the dentures from time to time in order to reestablish efficient function of the dentures and comfort to the patient. Efficiency and comfort to the patient may be prolonged over a long period; esthetic deficiency, which becomes evident in column 10, may be remedied by simple reconstruction.

DEDUCTIONS REGARDING CHART SHOWN IN FIGURE 1

The chart, "Occlusal Changes in Centric Relation," comprises twelve schematic articulator and sixty schematic anatomic masticatory apparatus, arranged in rows and columns. The horizontal rows are lettered by small letters from *a* to *h*, and the vertical columns by numerals from 1 to 10. Each individual figure is given the numeral and letter of the intersection of the column and row it occupies. This scheme affords convenient reference in the text to a column, row or figure. In a horizontal row, a case is followed through from the various initial modes of registration to the "worn-out" denture or patient, respectively.

The illustrations in the vertical column 1 show the anatomic apparatus with occlusal rims inserted, and a record interposed. "Taking the bite" in various ways is thereby illustrated. Here, when we consider correct and incorrect methods, we do not hesitate to use the collective term "taking the bite," though we feel that "registrations," "records of jaw relations" or "mouth records" should be established in the dental literature.

The "theory of advancing the bite" is not a mere accident. It is a useful idea veiled by half truths and has no legitimate relation to a spurious cult, except that it is an abused practice in conjunction with a misinterpreted mechanical provision of articulators and theories, so-called.[8] A conscientious investigator is not prone to misinterpretations. For him, they are the chaff to be eliminated from the wheat.

Now, what is there to associating centric occlusion with protruded jaw relation, occasionally with protruded-lateral relation? It is a useful expedient within narrow limits! We shall endeavor to find the limits.

The jaw relation records illustrated in column 1 in the chart shown in Figure 1 are: *a*, unstrained centric relation record (for *b*, we use registration *a*); *c*, strained centric relation record (for *d* we use registration *c*); *e*, unstrained protruded relation record (for *f* we use registration *e*); *g*, strained protruded re-

8. Monson's recommendations pertaining to advancing the bite. Proc. Nat. Soc. Denture Prosthetists, 1920-1923.

lation record (for *h* we use registration *g*).

The vertical columns, from the left to the right, give the various conditions which surround a denture from the time the mandibular registration has been taken in the mouth (already referred to in column 1), to the time the denture is considered worn out (a status quite undesirable for both patient and denture prosthetist). The legends at the head of the vertical columns specify the particular states of denture existence.

It will be noted that resorbed, displaced, strained and unstrained conditions are considered individually and associated. Conditions of condyle and denture bearing tissues are also considered singly and together. It is conceivable that, in some instances, the condyle region is affected by resorption; also that a strain may be acting on the denture supporting tissues and not on the condylar region. Therefore, I have given such contingencies consideration.

Column 1 illustrates records made in the mouth with occlusal rims.

Column 2 shows the next step. In each case, we take it for granted that the maxillary occlusal rim was transferred with the facebow and that the mandibular occlusal rim was mounted in the centric relation of the articulator, regardless of the mouth record under consideration.

Column 3 then follows. *a, c, e* and *g* show completed dentures in the articulator. These were constructed according to a former universal practice, namely with a "put fit" of the masticatory surfaces; while *b, d, f* and *h* were built according to my somewhat revolutionary idea, namely a "rocking fit" in centric relation. In column 3, the dentures are completed.

Columns 4 to 10 inclusive present the patient's jaws in centric relation with the dentures on the ridges and the tissues conforming to prevalent conditions (noted at the head of each column), showing the resulting occlusion in centric relation.

Column 4 shows the dentures in the mouth in unstrained centric relation, unstrained condyle tissues and unstrained denture supporting tissues.

Column 5 shows unstrained condyle tissues and strained denture supporting tissues. Such a condition, I accept, occurs only momentarily. This exceptional momentary transitional stage was not recognized by those responsible for the spread of the floating condyle theory, so named or implied.[9]

Column 6 shows unstrained condylar tissues, unstrained denture supporting tissues and resorbed denture supporting tissues; column 7, strained condylar tissues and strained denture supporting tissues; column 8, resorbed and unstrained condylar tissues and denture supporting tissues; column 9, resorbed and strained condylar and denture supporting tissues, and column 10, original opening relation, resorbed and unstrained tissues.

The object of these illustrations is to prove that none of the four different methods of jaw registration, each associated with four like methods of mounting the case in the articulator in centric relation, are leading to ideal results throughout the prospective life of a denture.

For convenience, I shall consider three states of denture existence. The condi-

9. Hall, R. E., in Wilson, G. H.: Manual of Dental Prosthetics, Philadelphia: Lea and Febiger, 1920. House's Articulator, a modification of the Hall Articulator since discarded by House and Hall. Kantorowicz and Schmitz: Zahnärztliche Rundschau, 1928, pp. 125 to 129.

tions depicted in columns 1, 2 and 3 represent the embryonic state, or the first state of a denture; 4 and 5 early life, or the second state, and the third state begins with column 6 (tissue resorption has started in this state and denture function suffers directly or indirectly).

I think of the beginning of resorption as a start from bad to worse. This period is terminated abruptly, only by providential mutilation of the denture before it has caused undue mutilation of the tissues or has become so intolerable that it has to be discarded.

I have tried to show, and from the chart shown in Figure 1, you cannot but recognize, some of the very conditions which have caused disappointment in your efforts to establish and retain centric occlusion associated with centric relation or the association of intended centric occlusion with centric relations. Have we not expected too much of instruments, theories and materials in overcoming the effect of the changes which I have demonstrated?

On closer study of the chart (Fig. 1), the figures in the horizontal lines *a* and *b* stand out as the most attractive results, and line *b* shows better and the more promising results from a statical point of view, although it does not show any marked occlusal superiorities over *a*. The figures in lines *a* and *b* show a progressively increasing protruded occlusion associated with centric relation in progress of resorption. The statical advantage of *b* over *a* is a more favorable distribution of pressure over the denture-bearing tissues, lowering the maximum specific pressure in the anterior region where it had to be resisted by the tissues.

In order to bring the resulting malocclusion to comparative bases, I have chosen a uniform condylar indication for the investigation, although realizing the effect of different condylar indications. The cusp height and other factors, which were here given no consideration at all, would cause the occlusion to appear more aggravated in some instances, and milder in other.

From the chart (Fig. 1), I see selected as the most favorable occlusal conditions those in row *b*. Of course, it did not escape my attention that figures 5*b*, 6*b*, 7*b*, 8*b* and 9*b* associated a slightly protruded occlusion in centric jaw relation which resulted in anterior interference causing a heavier pressure distribution in the anterior region. 7*b* is somewhat deceiving because the near-correct occlusion shown in this figure is partly due to a displacement of the dentures in consequence of the tissue accommodation under strain.

Horizontal rows *e* and *f* are nothing but illustrations of the common methods of advancing the bite, so-called. Note that the malocclusion incurred is just opposite to that shown in rows *a* and *b*, that is, where protruded occlusion was associated with centric relation in *a* and *b*, we find vertically below, in *e* and *f*, retruded occlusion associated with centric relation.

This is not a new discovery: the "migration of the bite" was observed by early pioneers. The intricacies, consequences and latent advantages of advancing the bite were also known to or sensed by them. Considering that pioneers had to blaze the trail, I take no exception to any of their interpretations of the phenomena and their way of counteracting them. I take delight in many of their inventive and skilful remedies. The method, however, of advancing the bite, recommended by some recent investigators who claim to master, or to have

applied, engineering principles, is inexcusable because in reality it violates engineering principles.

I recommend that engineering principles be applied to our problem. However, I insist that all principles, including those of engineering, must be safe and sound and not unstable, as, for instance, those which were advanced by Monson and his followers, who are responsible for an almost indiscriminate practice of advancing the bite, under the claim or belief that they are applying engineering principles. To apply one principle and disregard or violate others that are important is blundering.

I shall now point out briefly the two capital errors and a few speculations involved in advancing the bite as illustrated on the chart in Figure 1, horizontal lines *e* and *g*.

First, I took the bite by recording a protruded relation of the mandible of questionable magnitude and correctness in a patient whose condylar indications were unknown during this step in denture prosthesis, and secondly, I proceeded to mount a protruded jaw relation registered in the mouth, in centric relation in the articulator. In these two capital errors, I incorporated the involved speculations by assuming (*a*) that I am in a position to accept a magnitude of the required protruded jaw relation, (*b*) that I could accurately distinguish a protruded from a lateral or a protruded lateral jaw relation in the mouth, (*c*) that I could preconceive and gage or satisfactorily estimate the magnitude of a contemplated protruded excursion on a patient.

Advancing the bite under precisely these handicaps was widely practiced. It is an attractive and euphonious term well-chosen to describe an ill-chosen method. I prefer to be more exact and speak of associating centric occlusion with protrusive relation.

What is even more annoying than the choice of misleading terms are the unsatisfactory results of the method illustrated in the chart shown in Figure 1. You may have observed that particularly the followers of the spherical theory (also others) have made frequent use of "retruding the bite" and "advancing the bite" on their pet instrument, until the "bite is adjusted," as one once remarked with all implications of sincere conviction. Needless to state the nonadjustable and pseudoadjustable articulator have no standing in my opinion at all, which eliminates the Monson spherical instrument and technic. I do not approve of advancing the bite in the mouth of the patient. The method of advancing the bite in the mouth, and retruding the bite in the articulator being rejected as unsatisfactory, it remains for us to give consideration to a third expedient; namely, to associate centric occlusion with a protruded relation in the articulator after registration on the patient of centric relation and after mounting the case also in centric relation in the articulator with adjusted condylar guides.

To elucidate the method, which is by no means a new procedure throughout, we introduce the chart, "Occlusal Changes in Centric Relation" (Fig. 2). This chart is but a continuation of the horizontal rows of the chart shown in Figure 1, of the same title. Rows *a* and *b* are repeated in the second chart, so we may more succinctly compare them with the figures in rows from *j* to *o* inclusive. Aside from that, we have chosen a horizontal condylar indication and harmonizing occlusal surfaces. The degrees of protrusion are shown in column 2. In column 3, rows *j* to *o*, are shown the

dentures in centric occlusion associated with protruded relation of the articulator. It is assumed, however, that the dentures originally were built in centric relation of the articulator, as explained later.

Associating centric occlusion with protruded relation in the articulator implies that the same association is intended for the mouth, to begin with at least. I insist on carrying out this maneuver in the adjusted articulator, because I claim that it is the only reliable means for obtaining intended modifications of an association of occlusion with jaw relations. I am not disposed at this time to discuss the technic minutiae of the method, but shall confine myself to pointing out its principal requirements by enumerating the main technic steps:

1. Mounting the maxillary cast with the face-bow to the upper articulator jaw member.

2. Registration of centric relation in the mouth.

3. Mounting the mandibular cast to the lower articulator jaw member in centric relation.

4. Registration of condylar indications and adjustment of the condylar guides.

5. Protruding the articulator to the desired magnitude of condyle head excursions and retaining it in this position by interposing lead or zinc sheets of suitable thickness between condyle balls and stops in the Hanau articulator model H and the Hanau kinoscopes model A, B, C and A2, or adjusting the stop plate as provided in the Hanau articulator model F and the Hanau kinoscope model E.

6. Making a protruded articulator record of the accepted protruded articulation jaw relation (step 5).

7. Mounting a new upper cast having the articulator jaw members in centric relation, using the protruded articulator record made in step 6. The original mounting (step 1) of the maxillary cast is preserved for later (step 9) use.

8. Setting up the teeth in wax in balanced occlusion with the mounting obtained in step 7 and the condylar adjustments obtained in step 4.

9. The maxillary teeth set up in wax in step 8 are transferred to the mounted upper cast originally obtained in step 1.

10. The posterior teeth are readjusted in the wax rotationally about their axes on the working sides in lateral articulator excursions, without modifying the prominence of the compensating curves. The occlusion of the teeth when so set up is associated with relations as follows: (*a*) retruded occlusion with centric relation; (*b*) centric occlusion with slightly protruded relation; (*c*) protruded occlusion with protruded relation; (*d*) retruded lateral occlusion with lateral relation; (*e*) lateral occlusion, with protruded lateral relations; (*f*) protruded lateral occlusion with protruded lateral relations.

There are instances in which it becomes more advisable to associate centric occlusion with a lateral or a protruded-lateral relation than with protruded relation. The resulting balanced articulation for such cases associating occlusion with an unlike relation, we termed semiprosthetic articulation, in contradistinction to prosthetic articulation, which inferred occlusion associated with like relations.

The method to obtain any semiprosthetic articulation for a case is analogous to the one given, with this difference: for protruded, substitute lateral or lateral-protruded, etc.

We return to Figure 2, and find the better results in rows *l* and *m;* at least, I must admit that the types of occlusion

which were wanting in Figure 1 show some progressive improvement in some states of the life of a denture. And here again we note that the rocking-fit occlusion is best. From the six last rows, I deduce that I have prolonged the life of the denture at the expense of some generally accepted theoretical and practical requirements.

I now question whether (1) the improved results that I see in the figures are suitable for generalization, and (2) the investigation carried so far is exhaustive enough. To both questions, I answer no, because we have not given consideration to different condylar indications or the presence of cusps.

Individual condylar indications must be considered because the method of associating centric occlusion with protruded relation involves a constrainedly guided change of position of the condyle heads accompanied by a partially constrained change of position of the entire mandible. The opening is the partially constrained component movement, limited in closing only after occlusal contact of some sort is made.

I have spoken of quite a number of observations and deductions relating to occlusal changes in centric relation and have reviewed in a cursory way my previous findings. By no means could I do justice to the subject in the short space of time available for a lecture. It will be necessary to devote considerably more time and pages to this subject. A lecture for an occasion like this cannot be extended unduly and therefore you will permit me to close abruptly and reserve additional facts for a later discourse.

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DENTOLOGIA: THE FIRST DENTAL DIDACTIC POEM IN ENGLISH

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THE first dental didactic poem in any language, Julien Marmont's "L'Odontotechnie" (Paris, 1825),[1] was followed, after eight years, by the second work of the kind, the first in English, "Dentologia: a Poem on the Diseases of the Teeth, and Their Proper Remedies, by Solyman Brown, A. M." (New York, 1833, with an introduction by the author and a preface and notes by Eleazar Parmly).

Solyman Brown and Eleazar Parmly are well known as two of the fathers of dentistry as an organized profession.[2] The former was student-assistant to the latter when "Dentologia" was written and published, and the author of the poem tells us in the preface that he wrote it and dedicated it to Eleazar Parmly as a testimonial of their friendship.

1. Brown, L. P.: J.A.D.A., 16:1491 (Aug.), 1929.

2. See especially B. K. Thorpe's biographies in Koch's *History of Dental Surgery* Vol. 3, and L. P. Brown's *New Light on Dental History* in the *Dental Cosmos*, 62:936 (Aug.), 1920. More comprehensive sketches of both men will appear in the *Dictionary of American Biography*, now in course of publication.

A second imprint of the poem and notes appeared in Volume 1 of the *American Journal of Dental Science,* 1840-1841, and was also bound in separate form. A third imprint followed in Volume 3 of the same journal, 1842-1843. A fourth imprint, without the notes, was published in Stockton's *Dental Intelligencer,* 1844, while Solyman Brown's *Semi-Annual Dental Expositor,* 1852, contains a fifth imprint of the poem only, and the author there tells us, in a prefatory notice, that it was published originally by Eleazar Parmly "for gratuitous distribution among his friends." The text of the poem is identical in all these imprints; but, in a few places, differs slightly from the manuscript copy in possession of the present writer. Eleazar Parmly's notes, designed for the laity rather than the profession, are of little or no assistance in a review of the poem, but of some value to dental history.

"Dentologia" was favorably received by reviewers, as in the *New York Mirror* for Jan. 25, 1834 and the *American Quarterly Review* for June, 1834. It is highly commended by Chapin A. Harris in the *American Journal of Dental Science* (1:69-72, 1839). Many other dental writers notice it and quote from it, and two long passages are reproduced in Everest's "Poets of Connecticut," together with several of the author's short poems.

William H. Dwinelle said of Solyman Brown: "He was the poet laureate of our profession, and gave us 'Dentologia' and other poems, which will be read with profit and entertainment as long as our calling is known" ("Souvenir of the Dinner to Dr. Wilhelm Herbst," July, 1886, p. 22). Thorpe in his biography of the author calls him "the poet laureate of the dental profession," and says of "Dentologia": "This classical poem was a marked literary production, considering the subject . . . and had a great influence in elevating dentistry as a profession." In fact, the second imprint of the poem, in Volume 3 of the *American Journal,* probably saved that struggling periodical from an early demise; for, in the double issue of January and February, 1841, it is stated that the republication of the poem was sustained by some 300 subscribers to the journal, who paid for nearly 800 subscriptions at $5 each, some individuals taking as many as forty subscriptions; of course, for the sake of the poem.

The style of "Dentologia" is comparatively simple and easy, and the author tells us in his introduction that the poem was "intended to embrace some of the more general and popular views of the dental art." It is written in rhymed couplets and the ten-syllable verse popularized by Dryden and Pope, the influence of these poets sometimes being quite evident in Solyman Brown's poem. But his outstanding model, especially in some of his most effective verses, is readily recognized in Oliver Goldsmith's "Deserted Village," which poem had had a greater influence on English poetic style than any other single poem. There is no direct evidence that Solyman Brown was acquainted with "L'Odontotechnie," and while there are some resemblances to it in "Dentologia," one can hardly imagine two poems on the same subject that are more dissimilar both in manner and in matter.

"Dentologia" comprises 758 verses in all (thus being less than half as long as "L'Odontotechnie" with its introductory verses), and is divided into five cantos, each with a prefixed argument consisting of brief statements of the contents. All of these statements will be

introduced in the following review of the poem, most of them being utilized as topical captions (in parentheses) for conveniently indicating the subjects to which the quotations relate.

DENTOLOGIA: CANTO I

(Invocation to living beauty, as seen in the human countenance)

No goddess born in blue-eyed Juno's reign,
Or fair-haired sister of Apollo's train—
No coy and quivered Driad of the woods,
Or laughing Naiad of the dashing floods—
Do I invoke: ye fabled forms, retire!
Let breathing loveliness my notes inspire,
To thee, my cherished friend, the strains belong,
And living beauty animates my song.

This invocation seems to be particularly original. The dedicatory verse in the body of the poem (of course to Eleazar Parmly) was probably suggested by the opening verses of Pope's "Essay on Man."

Then, more than half of the canto is devoted to the following topics, with nearly a hundred verses, by way of general introduction: "Importance of personal charms to the female sex.—Man a natural physiognomist. — Mental and moral qualities mirrored in the features. —Original beauty of the human race.—Beauty of angelic natures when purified from the stains of mortality." This part of the poem includes some of its most poetical verses; those addressed by the author to his deceased mother, under

(Subject of dentistry proposed)

Be mine the pride in measured verse to raise
A plain but lasting monument of praise
To that distinguished science, known of yore,

. . . . . .

The Dental Art, by Greece and Rome admired.

. . . . . .

Full well I know 'tis difficult to chime
The laws of science with the rules of rhyme;
Plain, vulgar prose my subject seems to claim,
Did not ambition prompt the higher aim,
The nobler pride, by more laborous care,
To speak in numbers that shall please the fair.

. . . . . .

Since beauty thus bestows the kind caress,
And oft audacity secures success,
Be mine the task to join the tuneful throng,
And blend instruction with the charms of song.[4]

(Universal law of nature in regard to human teeth)

One common destiny awaits our kind:
'Tis this, that long before the infant mind
Attains maturity—and ere the sun
Has through the first septennial circle run,
The teeth, deciduous, totter and decay,
And prompt successors hurry them away.

The author probably means to say that they begin to totter, etc., for only the temporary incisors are shed before the close of the seventh year. But the text as it stands agrees with the erroneous statements of many early writers, including Pliny (Historia Naturalis, VII, 6).

(Importance of good dental practitioners)

Mark well the hour when nature's rights demand
The skillful practice of the dentist's hand,

. . . . . .

Beware of those whom science never taught
The hard but useful drudgery of thought,

3. In the manuscript (but not in the published version), there is a note here, addressed to Eleazar Parmly, in which the author says: "Deny me not therefore the tearful satisfaction of indulging in this brief allusion to her who first instructed me to express my thoughts in verse."

4. This verse and the second one following may have been suggested by Marmont's paraphrases of Horace:

Success sometimes has crowned audacity.

Try to unite the agreeable with the useful.

But similar epigrammatic expressions based on Horace were well known at the time, and Solyman Brown's "instruction" (instead of "the useful") is in accordance with Christopher Smart's popular translation of Horace (1765): "He who joins the instructive with the agreeable," etc.

DENTOLOGIA: CANTO II

(The first dentition, or the growth and progress of the milk teeth)

The first dentition asks our earliest care,
For oft, obstructed nature, laboring there,
Demands assistance of experienced art,
And seeks from science her appointed part.
Perhaps, ere yet the infant tongue can tell
The seat of anguish that it knows too well,
Some struggling tooth, just bursting into day,
Obtuse and vigorous, urges on its way.
While inflammation, pain, and bitter cries,
And flooding tears, in sad succession rise.

It seems that the author had anticipated himself by what he said on the same subject in Canto I. But he keeps fairly close to a well-defined plan throughout the remainder of the poem.

(Operation of lancing the gums.—Fatal consequences of neglect, or of inefficient remedies)

The lancet, then, alone can give relief,
And mitigate the helpless sufferer's grief;
But no unpracticed hand should guide the steel
Whose polished point must carry woe or weal.
With nicest skill the dentist's hand can touch,
And neither wound too little or too much.

. . . . . .

(The second dentition, or the formation and arrangement of the permanent teeth)

Nor less the danger when the first array—
The infant teeth—alternately decay,
Or yield succession to a hardier race
With marked reluctance;

In the next section, the author advises "extraction in case of interference, or mal-arrangement." Then we read:

(Distortion and deformity resulting from negligence)

Behold those organs wrested by abuse
From wisest purpose, and from noblest use;
Deranged, displaced, distorted, set awry,
Disgusting objects of deformity!

Such mal-formations hardier man perplex,
But with more grief afflict the softer sex:

. . . . . .

Let azure eyes with coral lips unite,
And health's vermilion blend with snowy white;
Let auburn tresses float upon the gale,
And flowery garlands all their sweets exhale;
If once the lips in parting, should display
The teeth discolored or in disarray,
The spell dissolves, and beauty in despair
Beholds her fond pretensions melt in air.

But learn the remedy: the dentist's skill
Subjects disordered nature to his will,

. . . . . .

In the next few verses, omitted for want of space, the author compares the dentist who regulates teeth to the commander who brings his disordered troops into line in the time of battle; and Marmont speaks of irregular teeth as "Bones which one might think were fighting among themselves."

(Perfection of the material of which the teeth are composed)

The eye, ear, lungs, heart, and other parts of the body are noticed as examples of the great law of perfection in creation, to which

The teeth conform; and hence it stands confest,
Their substance, form, and structure are the best
That wisdom could devise for such a use;
And hence, defective, only from abuse.

DENTOLOGIA: CANTO III

Canto III opens with a very effective "Apostrophe to Luxury," evidently suggested by the similar apostrophe in Goldsmith's "Deserted Village."

The author then considers luxury in its special relation to intemperate eating and indulgence in alcoholic drinks, the captions being: "Its effects on general health. — Intemperance in eating and drinking.—Use of animal food." The slaughter of animals for food is condemned in some of the strongest verses of the poem.

(Effects of luxury and intemperance on the teeth)

Amid this general wreck of health and ease,
Where every folly generates disease,
The teeth, in spite of nature's guardian care,
In all disorders of the system share.

. . . . . .

(Cleanliness; neglect of it punished by gangrene[5] of the teeth, and other diseases)

If sloth or negligence the task forbear
Of making cleanliness a daily care;
If fresh ablution, with the morning sun,
Be quite forborne or negligently done;
In dark disguise insidious tartar comes,
Incrusts the teeth and irritates the gums.

. . . . . .

(Fate of Urilla[6] occasioned by her carelessness)

Behold Urilla, nature's favored child;
Bright on her birth indulgent fortune smiled.

. . . . . .

When first I saw her eyes' celestial blue,
Her cheeks' vermilion, and the carmine hue
That melted on her lips; her auburn hair
That floated playful on the yielding air;
And then that neck within those graceful curls,
Molten from Cleopatra's liquid pearls;
I whispered to my heart: we'll fondly seek
The means, the hour, to hear the angel speak,
For sure such language from those lips must flow,
As none but pure and seraph natures know.

'Twas said—'twas done—the fit occasion came,
As if to quench betimes the kindling flame
Of love and admiration—for she spoke,
And lo, the heavenly spell forever broke;
The fancied angel vanished into air,
And left unfortunate Urilla there:
For when her parted lips disclosed to view
Those ruined arches, veiled in ebon hue,
Where love had thought to feast the ravished sight
On orient gems reflecting snowy light,
Hope, disappointed, silently retired,
Disgust triumphant came, and love expired!

. . . . . .

Let every fair one shun Urilla's fate,
And wake to action, ere it be too late;
Let each successive day unfailing bring
The brush, the dentifrice, and from the spring
The cleansing flood: the labor will be small,
And blooming health will soon reward it all.
Or, if her past neglect preclude relief
By gentle means like these, assuage her grief;
The dental art can remedy the ill,
Restore her hopes, and make her lovely still.

(Caries, or decay of teeth)

. . . . . .

Destructive caries comes with secret stealth
T' avenge the violated laws of health;
Dilapidates the teeth by slow decay,
And bears them all successively away.

. . . . . .

(The tooth-ache)

When caries, thus, the solid tooth destroys,
That sullen enemy to mortal joys,
The tooth-ache, supervenes—detested name,
Most justly damned to everlasting fame![7]

. . . . . .

They say who most have felt, and best should know
The power of this most execrable wo,
That when Pandora's box of mortal pains
Was first unlocked among the wondering swains,
To every vice its kindred grief was sent,
And every crime received its punishment,
Except intemperance; no *single* ill
Could heaven's irrevocable law fulfill,
The fixed resolve, th' omnipotent decree,
That each offense should meet its penalty;
Then all these mortal woes in one were joined,
And tooth-ache came, the terror of mankind.[8]
Thou haggard fiend! of hellish imps the worst,

5. Here, as again in Canto IV, and also in "Dental Hygeia," Canto II, "gangrene" is synonomous with "caries"; the author thus following Thomas Bell ("Anatomy, Physiology, and Diseases of the Teeth," 1831, p. 118.)

6. The name "Urilla" seems to have been coined by the author, as a feminine diminutive of the Biblical Ur, meaning "Light." Urilla's teeth decay through her own neglect, like those of Marmont's Zoe, but otherwise there is little or no resemblance between the two episodes.

This much admired section has been quoted often, in whole or part, and not only by dental writers, but also in the literary reviews cited above.

7. Apparently with reference to the opening verse of the "Address to the Tooth-ake" by Robert Burns: "My curse upon thy venom'd stang." The phrase "damned to everlasting fame" should be in quotation marks, as it is taken from Pope, speaking of Cromwell ("Essay on Man," IV, 6).

8. This addition to the generally received story of Pandora's box seems to be original with the author.

To mercy deaf, by sorrowing man accurst;
Though cheerless days made desolate by thee,
And long, long nights of sleepless agony,
Have marked thy fearful reign in days of yore,
Thy power is crushed—thy scorpion-sting no more
Affrights the helpless, for the dental art
Commands thy gloomy terrors to depart.

. . . . . .

DENTOLOGIA: CANTO IV

In the opening verses of Canto IV, the art of medicine is invoked to teach the author how to sing of the means employed in soothing the pains of humanity. But this invocation is unnoticed in the argument, where the first caption is:

(Remedies for the various disorders of the teeth)

. . . . . .

If then the teeth, designed for various use,
Decay and ache, 'tis only from abuse,
And lo, triumphant art can well ensure
At least a remedy, if not a cure.

(Filing away carious portions)

When caries comes, with stealthy pace to throw
Corrosive ink spots on those banks of snow—
Brook no delay, ye trembling, suffering fair,
But fly for refuge to the dentist's care.
His practiced hand, obedient to his will
Employs the slender file with nicest skill.
Just sweeps the germin of disease away,
And stops the fearful progress of decay.

(Stopping carious cavities with gold foil)

When long delay results in caries, the gold that man idolizes finds "one substantial use" in the stopping or filling of teeth; and as gold coins were still rolled and beaten into foil for dentists when "Dentologia" was written, we are told that the artisan

Transmutes its form with Caesar's head impressed,
Or in Napoleon's robes imperial dressed,
To soft and yielding lamina;—with skill
The practiced dental surgeon learns to fill
Each morbid cavity, by caries made,
With pliant gold:—

. . . . . .

(Loss of the teeth occasioning the necessity of substituting others)

Yet oft, through ignorance or negligence,
'Twere hard to say through lack of common sense,
The fatal spoiler works his secret way,

. . . . . .

'Tis thus the solid teeth, from year to year,
By folly or misfortune disappear.

. . . . . .

(Of artificial teeth)

But mark the triumphants of victorious art,
When sighing fair ones see their hopes depart,

. . . . . .

The lordly elephant, in hoary pride,
Toils through successive ages to provide
The ivory tusk; the fertilizing Nile
Breeds the huge hippopotamus, whose spoil
Supplies new treasures; and the ocean wave
Nurtures the sea-calf in his rocky cave,
To furnish fit materials to impart
Increased importance to the favorite art.[9]

Then we have an interesting catalog of materials employed in the early experimental making of porcelain for artificial teeth:

Behold the dental artist's bright array
Of magic wonders glittering to the day:
The white stalactite from the mountain cave,
The branching coral from the ocean wave;
The crystal from the rock; the gem that shines

With decompounded light from Indian mines;
And alabaster; and that yellow stone
That graces jealous beauty's virgin zone.[10]

. . . . . .

9. The manuscript has: "to the dental art."

10. From Shearjashub Spooner's "Essay on the Art and Manufacture of Mineral, Porcelain or Incorruptible Teeth." (New York, 1838), we learn that the materials then generally used for tooth-body were the following (in the order of proportionate quantity, and all ground fine): spar or feldspar; silex in the form of flint, quartz or rock-crystal; clay or kaolin; lime from chalk (added in small quantities by some makers), and oxide of titanium, from the ores known as sphene and rutile, to give the body a yellow color. Enamels were made of feldspar variously colored, with glass added by some. In "Dentologia," the "crystal from the rock" is evidently feldspar; the gem "from Indian mines" is silex

The canto closes with a "Eulogium on those who labor for the benefit of mankind."

DENTOLOGIA: CANTO V

Canto V opens with a highly poetical "Apostrophe to Health" and some verses on the joys of a healthful country life; the influence of Goldsmith's "Deserted Village" again being obvious.

The next topic is "Sympathetic action of disease on the system," followed by:

(Destructive influence of disordered teeth on the lungs, digestive organs and nervous structure)

But must the teeth, for various use employed,
Disturb the system when themselves destroyed;

. . . . . .

Nor less the nervous sympathy conveys
Each dental malady a thousand ways.

. . . . . .

(Influence of the teeth on health and longevity, arising from their relation to the solid aliments of man)

. . . . . .

But when from loss of teeth, the food must pass,
A crude, and rigid, and unbroken mass,
To the digestive organs, who can know,
What various forms of complicated wo
May rise terrific from that single source?

. . . . . .

(Importance of the teeth to the arts of eloquence and vocal music)

Here the anterior teeth are recognized as vocal organs, and are called "the dentals," as doubtless suggested by the current use of the term for the dental consonants.[11]

The value of good "dentals" or anterior teeth in enunciation is illustrated by verses relating to: "The commander addressing his troops on the eve of battle. —The advocate at the bar of justice, pleading the cause of injured innocence.— The venerable pastor exhorting his flock to pursue the path to heaven."

Under the last of these three topics, the author describes the village church where the "morning song of love" is sung on the Sabbath; and we have a continuation of this theme in

(The Fate of Seraphina)

Yet, in that choir that sung the morning song,
One vacant seat afflicts the listening throng;
One well known voice, admired so oft before,
For sweetest melody, is heard no more.

Is Seraphina dead, whose melting strains
Had won the hearts of all the neighboring swains?

. . . . . .

In silent grief, and unconsoled, she pines,
And scarce to heaven's high will her soul resigns,
For, lo, the heavenly music of her lip—
So sweet, the laboring bee might stop to sip,
Has passed away; discordant notes succeed,
And Seraphina's bosom lives to bleed.

Ye ask the cause: by premature decay,
Two of her dental pearls have passed away,
The two essential to those perfect strains,
That charm the soul when heavenly music reigns.
But fly, ye swains, to Seraphina fly,
And bid her fastly flowing tears be dry;

. . . . . .

And when ye find her, sooth her frantic mind,
And bid her cast her sorrows to the wind;
In secret whisper this kind truth impart;

or crystal in the very pure form of the Brazilian pebble (sometimes called "diamond") as conceived to be mined by South American Indians; and "that yellow stone" is one of the ores of titanium, probably rutile, which is sometimes cut and polished for jewelry. The stalactite (carbonate of lime), coral (calcium carbonate), and alabaster (calcium sulphate), were probably used in combination with silex as substitutes for clay and lime.

11. In a note to "Dental Hygeia," p. 53, Solyman Brown says: "The dentals of man, as of other animals, make their appearance at a very early period." Elsewhere we have noticed the use of the word "dentals" for actual teeth only in Landor's "Pentameron," 1837 (in his "Works," 2:344, 1846).

There is a remedy: the dental art
Can every varying tone with ease restore,
And give thee music sweeter than before!

APPENDIX

"Dental Hygeia, a poem, on the health and preservation of the teeth, by Solyman Brown, A. M.," New York, 1838, is dedicated to Augustus Woodruff Brown, a younger brother of the author, and has an appendix of notes. But in spite of the title, it is not a dental poem, being devoted to the general laws of health, with nothing of the teeth or dentistry except in two sections, one at the close of Canto I, and the other at the close of Canto II. We may reasonably suspect that these sections were later additions to a work originally relating to general hygiene.

After Canto I, "Addressed to Mothers," comes to a natural close, the dental section is connected with it as follows:

The muse has chanted thus her minstrel lay
Through devious paths in search of rosy health,
Which brings her to the burthen of her song.

. . . . . .

The teeth so highly priz'd
In nature's schemes of growth and nutriment,
Are twice produced in mercy to our race,

. . . . . .

The beauty of the face,
The part we wish mankind to know us by,
Where speak the moving passions of the soul,
Is quite disfigured if the teeth be bad;
But when in shining ranks of polish'd pearls
Untarnished by disease, they lend a grace
E'en to the plainest features, which not all
The jewels of the Indies could impart.

. . . . . .

And when corrosive tartar and gangrene
Assail the teeth, then summon to your aid
The skilful dentist . . . . . .

Canto II is "Addressed to Young Ladies," and the author connects the dental section with the preceding text by inserting some verses to the effect that it is not his purpose to give professional advise to the ailing unless the teeth are first to suffer. He says the teeth deserve careful cleaning after every meal and "when we wake at morn," as the salivary glands deposit tartar while we sleep; and he suggests that gangrene and decay of the teeth may result from hereditary tendency or constitutional disease. Then he continues:

Shall woman wear
Rich jewels, and array herself in robes
Of damask silk, ...
And yet neglect her chain of dental pearls,
Worth more than all the jewels in the world?

When Colombrosia, in an evil hour
By accident untoward, lost a tooth,

. . . . . .

I felt sincere compassion for her grief,
And told her so. And when Philosophine,
The victim of disease, and remedies
More hostile still to life, surviv'd to mourn
The loss of half her teeth, I sorrow' too.
But who will waste his sympathetic tears
In vain compassion for Melisabel,
Who scorn'd advice, and sneer'd at dentistry,
And vow'd she'd sooner sacrifice her teeth
And live on porridge, than subject herself
To inconvenience, labor, or expense,
To keep them healthy, clean and beautiful?
Now, they are black with tartar and gangrene,
Crumbled and crumbling, all but two or three
Which still retain their whiteness but to cause
The rest to look more hideous in decay.
The toothache, fiend insatiate, visits her
From day to day, more constant than her friends;
And when at night she covets balmy rest,
And locks her door to keep intrusion out,
The monster comes, a mighty incubus,
Worse than the nightmare, to her sleepless couch,
And bathes his poison'd arrows in her tears!

But Claroma, more favor'd than the rest,
And ever mindful of the laws of health,
Shall be a pattern for Columbia's fair.
. . . . . .
Her frequent exercise in open air,
Or mid the duties of domestic life,
Not deemed by her debasing, gives her cheek
The mellow lustre of the velvet peach
Bright crimson'd in the sun: and then her teeth,
As white as "monumental alabaster,"
Or the pearls which Anthony admir'd
In Cleopatra's bracelet, indicate
The rival pureness of her noble mind.

Canto III, the last, is "Addressed to Young Gentlemen," but has no dental section at the close; in fact, it contains not a word about the teeth or dentistry.

We also have "The Dental Student's Technical Course in Rhyme," by J. T. Tunnock, D.D.S., Melbourne, Australia, 1900 (254 pages and some five thousand verses). But this work is impossible from every standpoint.

JOINT LESIONS PRODUCED IN RABBITS BY THE LACTOBACILLUS*

By BEATRICE F. HOWITT, San Francisco, Calif.

WHILE we were working on a quantitative estimation of the mouth flora from a group of men in the state prison at San Quentin, Calif. (Howitt and Fleming, 1928[1]), a number of organisms were isolated belonging to the lactobacillus group of gram-positive aciduric rods. These rods fell into several groups, differentiated by their fermentation reactions in carbohydrate mediums. While we were endeavoring to establish the serologic relationship of these different strains by the production of agglutinins in rabbits, the following observations were recorded: Certain strains were pyogenic when introduced either subcutaneously or intraperitoneally into rabbits; and when given intravenously, they were capable of producing mucopurulent joint lesions in these animals.

A series of rabbit inoculations were made according to a standardized technic, to determine whether the different types were equally capable of producing lesions. In every case the intraperitoneal inoculation of one massive dose (the centrifugalized sediment of a 24 or a 48 hour culture in 50 c.c. of glucose broth, resuspended in 10 c.c. of the same broth) of each strain into a number of rabbits produced pus-containing nodules in various parts of the peritoneal cavity. The nodules were found at necropsy one week after the inoculation and were generally in the greater omentum or in the intestinal mesenteries, occasionally on the diaphragm, ribs, liver capsule, spleen or the bladder wall, lodged usually in the endings of the small blood vessels. A diffuse purulent infiltration was always found after a subcutaneous injection.

*From the California Stomatological Research group and the George Williams Hooper Foundation for Medical Research, University of California.

1. Howitt, B. F. and Fleming, W. C.: Quantitative Examination of the Mouth Flora Under Different Dietary Conditions, J. Dent. Res., to be published.

The inoculated organism as identified by fermentation reactions could usually be isolated in pure culture from the different lesions.

When rabbits were given repeated intravenous injections with the same uniform dose (the centrifugalized sediment from a 50 c.c. 24 hour glucose broth culture, resuspended in from 5 to 10 c.c. of glucose broth), the aciduric organisms giving the heaviest growth produced very definite mucopurulent exudates in the joints and occasionally in the adjacent tissues. The lesions were most frequently in the hindleg and the shoulder joints; less frequently in the foreleg or the hip joints. The synovial fluid was greatly increased, thick and mucoid, containing numerous macrophages and polymorphonuclear leukocytes and occasionally a few gram-positive rods. The latter were frequently phagocytosed within the leukocytes. Quite often, the purulent fluid spread along the muscle sheaths, usually visible as a bulky mass extending from the shoulder to the humoral joint. This process was much less frequently observed in the hindleg muscles.

At least two or three rabbits were injected with organisms representing each of the various types, two different methods invariably being employed. Either seven daily doses were given, followed by a rest period of one week before the animal was killed, or three daily doses each week until a total of nine injections had been made, also followed by a week's rest before the rabbit was killed. In each case, the results were about the same for the several strains, showing comparable bacterial plate counts. Those types which gave the heaviest growth in glucose broth and the highest bacterial counts invariably produced marked joint lesions; while those which produced less growth never gave the purulent synovial fluid. Occasionally a slight mucoid exudate with a few pus cells was present.

An attempt was made to inoculate those strains which were not active growers in glucose broth, in doses corresponding to those given from the more actively growing strains. In a few instances, a definite increase of joint fluid was observed. However, since it was difficult to obtain an equal number of organisms on account of the large amount of material needed, and since the animals usually died from an embolism before the experiment was finished, it was impossible to reproduce the extensive lesions induced by the injection of the active growing strains. The total number of organisms, both living and dead, was probably much greater than could be accurately estimated, thus causing a massive clogging of the capillary beds. Further experiments are contemplated in order to determine definitely whether or not this inability of certain strains to produce purulent joint lesions is an inherent quality of the strain itself or is merely due to a quantitative factor.

After intravenous injections, the organisms were generally recovered from the spleen and the liver, quite often from the kidney and the lungs, rarely from the heart blood. They were also isolated from the spleen and the liver after an intraperitoneal injection, but were never found in the joints, the lungs or the blood stream.

The evidence gathered from these experiments inclines one to the view that the production of joint lesions by such nontoxic organisms of low-grade virulence is largely due in the rabbit to the invasion and clogging of the capillary beds in the regions of poor circulation, as

suggested by Holman (1928)[2] in his review on focal infection, rather than to any particular specific elective localization as suggested by Rosenow and his coworkers (1919)[3] for the streptococcus.

That these aciduric rods are now also added to the list of the organisms producing joint lesions in rabbits seems of significance as the new strains used were all isolated from the oral cavity. Since the lactobacillus group has recently been implicated by several workers (McIntosh, James, and Lazarus-Barlow, 1922[4]; Bunting, Nickerson et al., 1928[5]) as the causative agent in dental caries, the continual invasion of the blood stream with these organisms from carious teeth may possibly be another source of joint infection in man.

Two known intestinal strains of lactobacilli were also used in this work, one of them being an active grower and the other relatively inactive, corresponding to the other types. The results were the same in the rabbits as those observed with the corresponding oral strains.

Similar lesions were also produced by several strains of the small gram-negative gas-forming mouth organism, *Micrococcus gazogenes* (Hall and Howitt, 1925[6]).

The detailed data and the technical procedures employed in this study will be assembled and reported elsewhere.

2. Holman, W. L.: Focal Infection and "Elective Localization," Arch. Path. & Lab. Med., 5: 68-136 (Jan.) 1928.

3. Rosenow, E. C.: Studies on Elective Localization, J. Dent. Res. 1:205, 1919.

4. McIntosh, J., et al.: Bacterial Origin of Dental Caries, Lancet, 1:1183-1185 (June 17) 1922.

5. Bunting, R. W., et al.: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 70:1-8 (Jan.) 1928.

6. Hall, I. C., and Howitt, Beatrice F.: Bacterial Factors in Pyorrhea Alveolaris. IV, Micrococcus Gazogenes, a Minute Gram-Negative, Nonsporulating Anaerobe Prevalent in Human Saliva, J. Infect. Dis., 37: 112-125 (Aug.) 1925.

METAPHEN IN PREVENTIVE DENTISTRY*

By GEORGE K. THOMSON, D.D.S., W.G. DAWSON, D.D.S. and R. P. SMITH, M.D., Ch.B., D.P.H, Halifax, Nova Scotia

IN February, 1928, in order to check the findings of Dr. Bunting and others and incidentally to interest the students of our graduating class in research, experiments were begun with patients from 7 to 10 years of age from charitable institutions who would probably be available for some years.

One patient was allotted to each student, who, under the dean's supervision, performed careful prophylactic treatments, necessary extractions and fillings and applied metaphen, obtaining cultures before and after treatment as suggested by Dr. Bunting, except that treatments were given once a week instead of daily.

This preparation is so well known through the publication of results of experiments by Dr. Bunting and others that it is hardly necessary to explain that

*Read before the Research Session at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 26, 1929.

it is an organic mercurial, which, in a solution of 1:500, appears to be many times more effective than any bactericides heretofore available, and particularly inhibitive to *Bacillus acidophilus.* Experiments conducted by our section are very incomplete but have progressed sufficiently for us to make a brief report, which we hope may be of some practical value.

The children are regular infirmary patients that report periodically for preventive treatment. Results of treatment are practically the same as those obtained by Bunting and others, and apparently weekly and daily treatments are equally effective. Cultures from mouths of healthy children with no caries show a very scanty growth of *B. acidophilus,* while those of children susceptible to caries show a profuse growth which diminishes on treatment and the use of metaphen as a mouth wash. Some healthy patients with neglected teeth and a scanty growth gave a negative reaction after one treatment and the use of a metaphen mouth wash. Others after a second treatment showed no bacilli for a year. Others after a year showed quite a positive reaction, which, after three treatments, became negative. The diet of these children is healthful, and recently the addition of raw carrots, given at 10:30 a. m. and 3:30 p. m. as a preventive of influenza, has proved beneficial to the general health.

PRESCHOOL-AGE CLINIC

In the preschool-age clinic, immune cases produced very scanty or no growth of *B. acidophilus,* while in the susceptible cases the bacilli were found in great profusion. Treatment is not practical in children of less than 4 years as they are difficult to control. From 4 years upward, it is valuable as an adjunct to prophylaxis, including "prophylactic odontotomy."

CLINICAL EXPERIENCE IN PRIVATE PRACTICE

In private practice, the number of cases seen has been insufficient to justify a definite statement, but, apparently, an improvement in general conditions of the mouth followed this treatment. If a solution stronger than 1:5,000 is used as a mouth wash, a dark stain appears on the teeth. This can easily be removed by pumice. The use of mouth wash in a solution of 1:5,000 produces very little, if any, stain. In periodontoclasia and Vincent's infection, a combination of metaphen and neo-arsphenamin in fresh solution is apparently effective, but sufficient data to warrant the publication of results are not available.

While we recommend these methods as valuable adjuncts to those already in use by busy practitioners, we realize that this association is more concerned with the development of research, administration and teaching than with private practice, and we suggest that research of this practical nature be advanced by encouraging and requiring undergraduates to participate in it.

THE LIBRARY BUREAU OF THE AMERICAN DENTAL ASSOCIATION: ITS PRESENT ACTIVITIES AND FUTURE AIMS*

By JOSEPHINE P. HUNT, Librarian

FOR many years, the American Dental Association has recognized the need for a dental library—one which would be not only a storehouse for dental literature and records, but which would also make readily accessible the published information on whatever subject might be considered of special interest. In 1923, in his "President's Address to the House of Delegates," Dr. Buckley very ably expressed his opinion in these words: "The standing or character of a profession can best be judged by its literature. In this respect, dentistry need offer no apology; but organized dentistry should have a library of its own equal to the best. The library should contain everything in the way of reference, be complete in every particular, all dental literature, national and international, properly indexed. . . . This would not only augment and encourage our research workers; but would reflect greatly to the credit of our profession." The functions of a library, as he saw them, were complex enough, but the widely scattered membership presented an additional problem. How could the resources of the library be made available, for instance, to a member in Wyoming? Because many dentists are not familiar with what has been accomplished by the Library Bureau or with its aims for the future, a brief outline of its activities is here set forth.

Before the advent of the present librarian, the nucleus of a dental library had been assembled. Each year, the more prominent dental journals had been bound and put on the shelves, state transactions had been collected and even some medical and dental books had been acquired. Dr. W. H. De Ford had a large medical and dental library and the Association is indebted to him for most of the older books which it now possesses. In addition to the newer books which were acquired by purchase, the collection has been greatly augmented through the generosity of Dr. C. N. Johnson, as he turns over to the library all of the books that he reviews in THE JOURNAL. Many authors have been exceedingly thoughtful in presenting the library with copies of their books. Also, some of the publishers of dental books have contributed copies for exhibition at the national meetings and these have afterward been added to the library. All books in the Association library are circulated with the exception of bound volumes of magazines, transactions and out-of-print editions which could not be replaced in case of loss. Members, no matter where located, who wish to borrow books may do so on forwarding a deposit of $2.00 with their request.

*Located at 58 East Washington St., Chicago, Ill.

In order that reference service would be available to men who cannot come to the library in person, and because of the impossibility of circulating the bound volumes of magazines, some method had to be devised whereby these members could refer to magazine articles. To meet this situation, package libraries on many subjects pertaining to dentistry have been compiled. Each package consists of magazine clippings, reprints, etc., on one subject. Packages on additional subjects will be assembled on request. When a dentist asks for a package library on some particular subject, an effort is made to include any special articles which he may particularly wish to see. Some members consult Dr. Black's "Index of the Dental Periodical Literature" to find articles by certain authors and ask that as many of these as possible be included in the package. Others have heard certain papers read at meetings and wish to refresh their memories regarding the subject matter. Where no special mention is made as to what authors' articles are particularly desired, it is the policy to include as large a percentage as possible of recent material. Usually, a package library contains about twenty articles.

Fig. 1.—The Library.

The number of package libraries on one subject varies with the interest in the subject. In some instances, ten or fifteen packages are insufficient to care for all requests immediately, and it is necessary to have a waiting list. The names of the

dentists are put down in the order in which the requests are received and they are given attention in turn. It is surprising to note how the interest of the profession varies as indicated by its requests for information. One month, the greatest number of calls may be for literature on Vincent's infection. Another month, dental economics may be the subject most frequently asked for; and a short time later, the material on focal infection may be most in demand. In this connection, it might be stated that on controversial subjects such as focal infection, the articles selected do not represent one side of the question, but give a comprehensive idea of the current opinion on that subject as represented by a wide range of dental literature. Frequently, the same package includes articles expressing absolutely contrary opinions.

Many inquiries have been made as to how clippings for the package libraries are kept and classified. All clippings are put in pamphlet cases. Each pamphlet case is devoted to one subject and all cases are arranged alphabetically according to subject. (Fig. 2.) Originally, there were only about thirty headings for these cases. As more and more material was collected, finer divisions were made. For instance, instead of all articles on oral surgery being in the case labeled "Oral Surgery," the material on fractures and that on the maxillary sinus are placed in separate cases. The first request

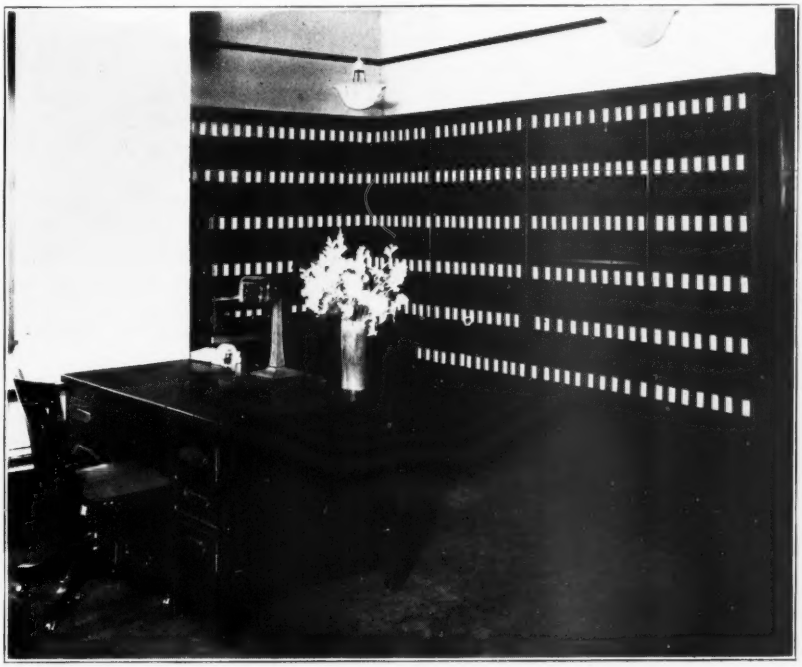

Fig. 2.—Corner of Library, showing pamphlet cases containing package libraries.

for material on a subject is always the most difficult to fill. Sometimes, several days are spent finding and clipping articles. After the references to a subject are located by means of various indexes, it is then necessary to take out and clip the journals containing the desired articles. Occasionally, a request comes for a subject on which not even one entire article can be found. In this instance, many articles are scanned for the needed information and the paragraphs of special interest are indicated in the margin.

To make a package library service possible and worth while, it was necessary to procure a vast number of magazines which could be used for clipping. To make a beginning, letters were written to publishers of dental journals not only in the United States, but also in Canada, Australia, New Zealand, etc., explaining the proposed service and requesting their cooperation. Almost without exception, the responses from the publishers indicated their willingness to be of assistance. Some sent in files of old journals; others placed the Bureau on the mailing list for future issues. Several publishers voluntarily suggested sending copies of all of their reprints. An appeal was also printed in THE JOURNAL, asking dentists to send in such magazines or reprints as they could spare. Immediately, letters poured in offering journals. Some dentists sent the accumulation of many years. As a result of all this enthusiastic cooperation, a worth while package library service has been evolved.

Frequently, a request is received in which it is felt that the dentist is in urgent need of help. Not long ago, a telegram came requesting that material on fractures of the zygoma be sent back by the first air mail. Articles on broken needles and foreign bodies in the esophagus have also been called for and a request has been added that the material be rushed.

During his administration, Dr. Giffen made a study of dental and medical libraries in order that he might offer recommendations regarding the use of the library fund. He concluded, after this investigation, that medical and dental libraries were quite expensive. This is true, but it is also true that only by having the library used to a considerable extent is the greatest return received from the expenditures involved. Many of these expenditures are approximately the same whether or not a library is used extensively. Each year, certain magazines have to be bound. After this is done, storage space must be provided for them, which necessitates not only procuring shelving but also allotting a place for the shelves. To be easily used, the books in a library must be catalogued and arranged in some logical manner. All this necessitates the attention of a librarian. These and other costs do not vary in proportion to the amount to which a library is used. It is estimated that of the present cost of operating the Library Bureau, approximately 75 per cent is unavoidable expense and the remainder is the result of circulating the books and packages by mail. About twenty-five times as many books and packages are sent out by mail as are called for at the library. Therefore, by adding about 25 per cent to the cost, the library increases its usefulness approximately twenty-five times.

There are two groups who use the library to a notable extent: those who are giving clinics, writing papers, etc., who naturally wish to see what previous study has been given to a subject, and the dentists who are rather isolated and find themselves facing a special problem. One dentist who makes frequent use of the

service wrote in saying that he considered it the equivalent of a postgraduate course.

From time to time, lists of the recent books available for circulation are published in THE JOURNAL. One of these appeared in THE JOURNAL for July, 1929, pages 1343-1346, and in the June issue, pages 1148-1150, was a list of the package libraries which have been compiled. At the meeting of the American Dental Association in Washington, D. C., copies of these lists will be distributed to dentists visiting the American Dental Association exhibit. They will be mailed, on request, to dentists not attending the meeting.

A number of state associations and dental schools are starting or are building up dental libraries. It is the purpose of the Library Bureau to help these libraries in every way possible. Some of these libraries already have been assisted by gifts of books or magazines; some have been sent information relative to classifying material; and for several, special lists of books have been compiled. The Library Bureau is glad at any time to do anything possible for these libraries. Several libraries have sent in lists of the magazines needed to complete their files and such duplicates as are available have been given them.

The space now allotted to the Library is nearly double that which it formerly occupied, and dentists wishing to use the Library for reading or reference purposes can be readily accommodated. All members of the Association are cordially invited to visit the Library in order to acquaint themselves with the material at hand.

The Library in the two years that it has functioned as a Bureau has not grown to any great size, as the assembling and cataloging of a great number of books could not be accomplished in such a short time, nor could any great number of package libraries be compiled. However, there has been a steady increase both in the amount of material which the Library Bureau makes available to the profession and in the number of calls for service. It is hoped that it has already demonstrated its usefulness and that it will become a vital factor in the development of the dental profession.

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C. N. JOHNSON, Editor

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Editorials

THE COST OF DENTAL CARE

There seems to be, at the present time, a rising tide of interest in the cost of professional service to the public. The first outspoken demonstration of this interest was the formation in May, 1927, of an organization known as the Committee on the Cost of Medical Care. This was a representative body made up of leading men of professional and economic prominence, and this program embraced a five-year study of the situation as a beginning toward an ultimate solution of the problem. We made editorial reference to this committee in the September number, in 1928, and since that time there has been considerable activity on the part of the committee.

In dentistry, we have an ever-increasing interest in this subject, as is manifest by a desire on the part of dental societies to have papers read before them dealing with dental economics. One organization, the Chicago Dental Society, has appointed a com-

mittee of thirty to study the problem, and this committee is laying out a very comprehensive program. The argument of the Committee on the Cost of Medical Care is not that professional men are too highly paid but that somehow it is costing the public too much to be ill. How these two ideas are to be reconciled and harmonized is the problem presented for study, and this problem is affecting the dental profession in precisely the same way as it is the medical profession, with possibly a few modifying circumstances.

The necessity for medical service is frequently more insistent than the need for dental service. If an individual has pneumonia, typhoid fever or a broken arm, there is instant recognition of the necessity for medical care; but if a tooth is lost, the individual may, and often does, go with a vacant space in the mouth. Dentistry, in certain quarters, is considered more of a luxury than a necessity, and this has a direct bearing on our economic problem. It is true that as people become educated in the significance of dental service, they begin to consider it in the light of a necessity, and today there is a wider recognition of the vital importance of dentistry than ever before, which will eventually translate itself into a definite economic advantage.

But what concerns us at this time is the concrete question of compensation. Do dentists receive too much for their services? Or, in other words, are dental fees so high that people cannot have the work done that they themselves deem necessary? The answer to these questions must in all fairness be in the negative. There may be exceptional cases of extravagant charges on the part of dentists, but, for the most part, dental fees are too low rather than too high; and with economic conditions as they are in this country, the majority of people can afford to pay the fees usually asked. It is all in the point of view, and the present point of view attained by most people is that they would rather have automobiles than dental service. Nor can we logically or successfully quarrel with this attitude. While we have the settled conviction that dental service is more important to the well-being of the individual than the possession of an automobile, the fact remains that people will have their way in the matter and that the automobile has almost suddenly transferred

itself from the status of a luxury to that of a necessity in the minds of many persons, the members of the dental profession among the rest.

Not to mention the automobile, there are many extravagancies of the age that are taking the money of the people in quantities that would adequately care for their dental needs if diverted to that use; and the problem is to educate the people to this point of view. Gradually, the information is spreading that, in the preservation of the health, the teeth must be considered a most important factor, and the significance of health as an asset to the individual and the community is becoming more and more apparent to every one concerned in the welfare of the people. The members of our profession know only too well that if adequate attention were given the natural teeth from infancy up, it would add years to the longevity and efficiency of the race, and this knowledge should be brought home to the consciousness of the people in every possible way. If there was a proper realization of this fact on their part, the question of compensation for dental service would not be the debatable one that it is today. Dentistry would justify itself if given an opportunity, as it always has when tested in the alembic of concrete practical experience.

The people who contend that the cost of dental care is too high fail to comprehend two things: they fail to realize the true value of this service—the actual benefit that it brings to the one who receives it—and they also wholly overlook the toll that it takes from the man or woman who delivers the service. Dental work well and conscientiously performed exacts from the operator a physical and nervous sacrifice that few people can comprehend, and there is no recompense in reason that should be considered too high when the service is faithfully performed. The difficulties under which most of the work is done subject the operator to a tension which sooner or later depletes his energy and destroys his physical balance unless he is unusually vigorous or takes every precaution to preserve his health by the most scrupulous care and the closest attention to the rules of correct living. To work all day long in a strained position on tissue that is sensitive or that is likely to become sensitive at any

moment leaves an operator at the end of the day in such a state of fatigue or even of utter exhaustion that to question an adequate fee for such service is little short of ingratitude and injustice. If dentists received no more than the financial returns which result from their service, there would not be much incentive to practice a profession so exacting, but, as a matter of fact, a large part of their reward comes from a sense of having achieved a definite good for their patients, and, in many cases, from having those patients give expression to their appreciation for the service rendered. The real rewards of professional life come not from the accumulation of wealth but from the pleasurable contemplation of having added definitely to the sum total of the efficiency and happiness of the human race.

Remove dentistry from the activities of modern society and the health of the people would slump in an appalling way, and thus we are prepared to contend that the cost of dental care is, after all, very trivial compared with the benefit rendered to the people. This has no reference to the isolated cases of dentists charging grotesque or unreasonable fees, but to the earnest and painstaking members of the profession who give full value for fees that are reasonable and that are within the legitimate reach of the rank and file of the people. And it is this class of professional men and women who constitute the large majority of those who practice dentistry. When the cost of dental care is being discussed, let us study the equity of the question and try to arrive at an estimate that is just to all parties concerned. If this is done, we have little fear that the members of our profession will need to hang their heads in contemplation of the fees they charge.

DEFEAT

A man never experiences real defeat till he acknowledges it himself. To keep coming back after a knock-down is often to win in the end. The spirit of never-say-die is at the back of every victory, and the acknowledgment of defeat is defeat itself. Foolish over-

confidence may sometimes lead to disaster, but overconfidence is better than no confidence at all.

There are many varieties of defeat in life, and the greatest defeats are not of a physical character. To lose in a contest of muscular strength and stamina is not to suffer the worst kind of defeat. Defeats are recorded daily in the sporting world, but they are not in any sense fundamental. They are fleeting in character and are soon forgotten except by the defeated ones. The defeats that really count are of a different kind—they are defeats of purpose and principle, defeats of mental attitude toward one's fellowman. If you harbor envy, hatred, resentment or revenge against any one, you are a defeated individual. Nothing undermines or incapacitates a man as does vicious thinking, nothing sustains him in the trials of life as does generosity of thought. To be tolerant and charitable is to win; to hate and distrust is to lose.

Impatience holds within it the germ of defeat, and the man who cannot control himself can never be expected to control others. Loss of temper always places an individual at a disadvantage and makes him vulnerable. To lose your temper is to suffer defeat, whether or not you gain your immediate and material point. If you do an unworthy thing or miss an opportunity to do a worthy one, you are defeated. If you permit a false statement to be made of some one without correcting it, particularly if the one about whom it is made is your enemy, you are doubly defeated. If you wish to experience real triumph, do a generous act to the one who has reviled you, and your reward will be something beyond all estimate. Try it—it never fails.

Any indulgence on your part in idle gossip or derogatory statements of others, any unworthy criticism or misrepresentation, inevitably leads to a disintegration of character in yourself, and this is the forerunner of ultimate defeat. Magnify the good qualities of others and forget their limitations—you may want your own limitations forgotten. You become petty yourself if you indulge in pettiness against others, and there is nothing more despicable in the minor offences than back-biting gossip.

Remember this one fundamental fact: the worst defeats of life

are not inflicted on you by your enemy but by yourself. Your enemy may strive to injure you, but his most vindictive efforts can never work the injury to you that comes from your own misdeeds. Every time you permit yourself to do an unworthy act, you help to accomplish your downfall.

Look yourself in the face and let this fact sink into your consciousness. Make no mistake: you will never control others till you learn to control yourself, and you will never escape the pitfalls that lead to defeat till you gain command over your own temper and your own tendencies. Life is filled with opportunities many of which are permitted to pass by because of narrowness of vision, and much of our narrowness is brought about by a selfish consideration of our own interests and a failure to recognize the interests of others.

The great outstanding limitation of humanity is lack of vision, and this leads to a selfishness which handicaps our lives and places an embargo on our most worthy efforts. We would never be selfish if we had a sufficient reach of vision, because this would teach us unerringly the utter folly of being selfish, and the impossibility of ever achieving any worthy purpose while selfishness consumes us and directs our policies of life. To be selfish is to suffer a real defeat, the worst defeat of all, because selfishness will ruin the happiness of the most favored individual in the world; and if the ultimate destiny of humanity is to achieve happiness, anything that thwarts it is bad, anything that contributes to it is good. The fundamental law of life is that every individual was created to be happy, and to the exact degree that we are not happy are we suffering defeat in the fact that we are failing in the manifest purpose of our lives.

The most encouraging aspect of our defeats is that, for the most part, we will find that many of them are amenable to control and even to prevention. If we admit, as we must, that the worst defeats are those emanating from ourselves, it merely becomes a question of reckoning with ourselves in the proper way to bring about an avoidance of defeat. This we can do if we go resolutely at it, in the proper spirit and with the proper determination, in other words, it is mostly up to us whether or not we suffer defeat in life. Every man must make his own choice. If he is indifferent to his destiny,

let him go on accepting defeat as part of the program of his life; but if not, let him rise to his possibilities and enter into the heritage which is the essential right of every human being. In other words, it is not natural to be continually suffering defeat. It is only when our vision becomes perverted, and we are something other than ourselves, that defeat really comes to us.

THE NEW BUILDING OF THE TOKYO DENTAL COLLEGE

It was only six short years ago that the terrible disaster in Japan completely demolished the dental colleges of Tokyo, and among them the Tokyo Dental College of which Dr. Morinosuke Chiwaki is the president and leading spirit. At that time, the devastation was so great that it seemed almost beyond the possibility of recovery, and yet in the short time since then we have a vivid demonstration of the splendid spirit embodied in the Japanese character as represented by the beautiful new building that has been erected for the Tokyo Dental College. Reference to the illustration will give some idea of the character of this magnificent structure, which would do credit to any period or any country.

The area of the main building is 79,488 square feet, and that of the annex 16,416 square feet, making a total of 95,904, which will adequately accommodate a large body of students and give them the facilities for instruction second to none. The completion celebration of this building is planned for the present autumn, and an international dental exhibit is being held in honor of the event.

At the time of the earthquake, in addition to the loss of the building, there were countless rare specimens of interest to dentists destroyed in the museum of the college, and Dr. Chiwaki and his colleagues are gathering together another collection, which they hope may not only take the place of the previous one but may even excel it. It would be a very gracious thing for members of the profession in America to contribute specimens to the upbuilding of this museum. The courage and indomitable spirit displayed in the

face of the appalling disaster of 1923 is deserving of recognition by the profession everywhere, and we bespeak the cordial cooperation of the dentists of this country in an effort to make good as far as possible the losses sustained at that time in the museum of the Tokyo Dental College. Anything in the way of specimens or photographs illustrative of the past history or the present advances of dentistry will be welcomed, and they will serve as another link to bind the two countries together.

As has been said, the president of this institution is Dr. M. Chiwaki, and the superintendent is Dr. T. Okumura, to either one of which the material may be sent. The address is The Tokyo Dental College, Misaki-Cho Nichome, Kanda, Tokyo, Japan.

BUREAU OF CHEMISTRY

FORHAN'S PYORRHEA ASTRINGENT

"FOUR OUT OF FIVE." This is the catchy slogan a dentifrice manufacturer plays upon to bring his wares to the attention of the public. This "4 out of 5" slogan, if one is curious enough to investigate further, refers to the broadside, "4 persons out of 5 after forty and thousands younger" succumb to the ravages of pyorrhea. Inferentially at least, you may be the one who isn't immune. But hope is held out. The daily use of this dentifrice, so it is inferred, will stave off the insidious "diseases that attack the gums . . . ." This toothpaste is Forhan's for the Gums, which we are told is:

> . . . far more than ordinary toothpaste. It is the formula of R. J. Forhan, D.D.S. It is compounded with Forhan's Pyorrhea Liquid used by dentists everywhere.

As the advertising to the public states that this toothpaste is compounded with "Forhan's Pyorrhea Liquid used by dentists everywhere," it is the latter preparation which forms the subject of this report.

To the public, the preparation is called "Forhan's Pyorrhea Liquid"; to the profession it is called "Forhan's Pyorrhea Astringent" (Forhan Company, Inc., New York). One is led to wonder if this is to keep the public in ignorance concerning the astringent nature of the preparation.

Forhan's Pyorrhea Astringent, it is claimed, is sold only to the dental profession. The following statement, reminiscent of an earlier generation, is made:

> And for the best interests of the Dental Profession the formula is protected from publicity . . . . These factors commend it to the ethical practitioner.

We are not aware that ethical practitioners advocate the use of secret remedies. In this connection, it is timely to reproduce an editorial statement from a recent issue of THE JOURNAL:

> No honest manufacturer will ask a professional man to use a secret remedy, and no honest professional man will use it even if he is asked.

One wonders if R. J. Forhan, D.D.S., whose name and dental degree are used in marketing this product, expects dentists who have a high regard for scientific dentistry to approve of the secret nature of his remedy.

According to statements on the label, Forhan's Pyorrhea Astringent can be used:

> . . . in the treatment of PYORRHEA ALVEOLARIS, chronic ulceration of the Gums, Pyorrhea Pockets, Suppurating or Pus Discharging Gums.

The following blanket directions are evidently intended to cover all cases, with no regard to individualization, for which the product is sold:

> After all deposits have been removed from the roots of the teeth, carry preparation to bottom of pyorrhea pockets with an abscess syringe, orange stick or toothpick. Never inject with hypodermic syringe.

Thus, dentists are asked to use a preparation without being advised of the composition of this apparently dangerous mixture for which the vendor finds it necessary to caution, "Never inject with hypodermic syringe."

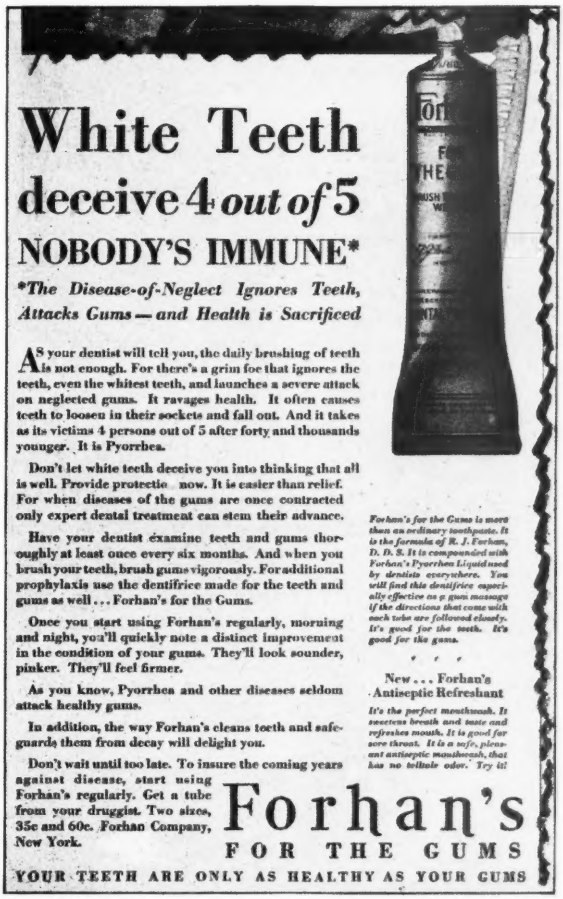
White Teeth
deceive 4 out of 5
NOBODY'S IMMUNE*
*The Disease-of-Neglect Ignores Teeth, Attacks Gums — and Health is Sacrificed
As your dentist will tell you, the daily brushing of teeth is not enough. For there's a grim foe that ignores the teeth, even the whitest teeth, and launches a severe attack on neglected gums. It ravages health. It often causes teeth to loosen in their sockets and fall out. And it takes as its victims 4 persons out of 5 after forty and thousands younger. It is Pyorrhea.
Don't let white teeth deceive you into thinking that all is well. Provide protection now. It is easier than relief. For when diseases of the gums are once contracted only expert dental treatment can stem their advance.
Have your dentist examine teeth and gums thoroughly at least once every six months. And when you brush your teeth, brush gums vigorously. For additional prophylaxis use the dentifrice made for the teeth and gums as well ... Forhan's for the Gums.
Once you start using Forhan's regularly, morning and night, you'll quickly note a distinct improvement in the condition of your gums. They'll look sounder, pinker. They'll feel firmer.
As you know, Pyorrhea and other diseases seldom attack healthy gums.
In addition, the way Forhan's cleans teeth and safeguards them from decay will delight you.
Don't wait until too late. To insure the coming years against disease, start using Forhan's regularly. Get a tube from your druggist. Two sizes, 35c and 60c. Forhan Company, New York.
Forhan's for the Gums is more than an ordinary toothpaste. It is the formula of R. J. Forhan, D. D. S. It is compounded with Forhan's Pyorrhea Liquid used by dentists everywhere. You will find this dentifrice especially effective as a gum massage if the directions that come with each tube are followed closely. It's good for the teeth. It's good for the gums.
New ... Forhan's Antiseptic Refreshant
It's the perfect mouthwash. It sweetens breath and taste and refreshes mouth. It is good for sore throat. It is a safe, pleasant antiseptic mouthwash, that has no telltale odor. Try it!
Forhan's
FOR THE GUMS
YOUR TEETH ARE ONLY AS HEALTHY AS YOUR GUMS

Fig. 1.—Doctor: Do you believe that oral-health education that preys on the fears of the public will develop a sane attitude toward dental health?

The Chemist has the following to say regarding the composition of R. J. Forhan's preparation:

A. D. A. CHEMIST'S REPORT

"Eight (8) original packages of Forhan's Pyorrhea Astringent, price $2.00 each, (Forhan Company, New York City, N. Y.) were purchased on the open market for examination.

"Each bottle contained approximately 18 c.c. (approximately 3/5 fluid ounces)

of a clear, red, odorless liquid, with a small amount of a white sediment on the bottom. The liquid possessed a strong burning and astringent taste. It had a specific gravity of 1.432 at 20 C., and was acid to litmus, probably owing to the presence of free hydrochloric acid as found in the quantitative determinations.

"Qualitative tests indicated the presence of zinc, cobalt, chlorid, nitrate and glycerin. Aluminum, mercury, lead, silver, iron, copper, sulphate, iodid and tannin-like compounds were not found.

"Quantitative determinations yielded:

Total solids 130 C. . . . 51.5 per cent
Zinc (Zn^{++}) . . . . . 16.6 per cent
Cobalt (Co^{++}) . . . . . 0.2 per cent
Chlorid (Cl^{-}) . . . . . 18.4 per cent

"From the foregoing it may be calculated that Forhan's Pyorrhea Astringent contains essentially:

Zinc chlorid ($ZnCl_2$) . . . . . 49.6 gm. per 100 c.c.
Cobalt nitrate ($Co(NO_3)_2.6H_2O$)[1] . . . . . 1.4 gm. per 100 c.c.
Hydrochloric acid, free (HCl) . . . . . 0.5 gm. per 100 c.c.

1. All the cobalt was calculated to cobalt nitrate.

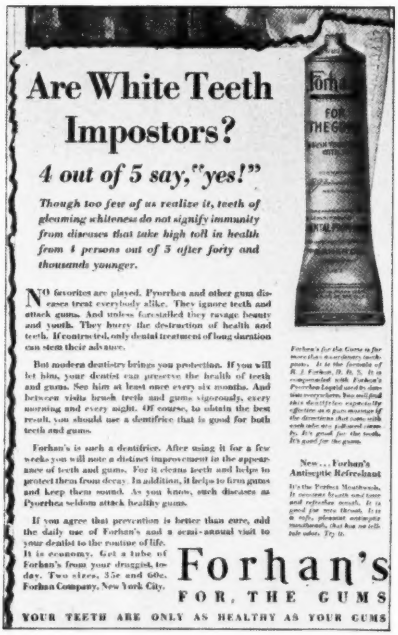
Are White Teeth Impostors?
4 out of 5 say, "yes!"
Though too few of us realize it, teeth of gleaming whiteness do not signify immunity from diseases that take high toll in health from 4 persons out of 5 after forty and thousands younger.
NO favorites are played. Pyorrhea and other gum diseases treat everybody alike. They ignore teeth and attack gums. And unless forestalled they ravage beauty and youth. They hurry the destruction of health and teeth. If contracted, only dental treatment of long duration can stem their advance.
But modern dentistry brings you protection. If you will let him, your dentist can preserve the health of teeth and gums. See him at least once every six months. And between visits brush teeth and gums vigorously, every morning and every night. Of course, to obtain the best result, you should use a dentifrice that is good for both teeth and gums.
Forhan's is such a dentifrice. After using it for a few weeks you will note a distinct improvement in the appearance of teeth and gums. For it cleans teeth and helps to protect them from decay. In addition, it helps to firm gums and keep them sound. As you know, such diseases as Pyorrhea seldom attack healthy gums.
If you agree that prevention is better than cure, add the daily use of Forhan's and a semi-annual visit to your dentist to the routine of life.
It is economy. Get a tube of Forhan's from your druggist, today. Two sizes, 35c and 60c.
Forhan Company, New York City.
Forhan's
FOR THE GUMS
YOUR TEETH ARE ONLY AS HEALTHY AS YOUR GUMS

Fig. 2.—More "4 out of 5" advertising to the public. Is oral-health education that preys on the fears of the public constructive?

A Pyorrhea Treatment that Justifies the Practitioner's Confidence
THE FORHAN METHOD of Treatment for Pyorrhea Alveolaris is removed from the sphere of experiment. Its uniformity of excellent result is a known quantity.
Thousands of the leading American Dentists now use it. They realize if an astringent is used it must be of just the right potency to heal and harden the gums, and mitigate any inconvenience caused by the necessary "scaling" and cleaning out of pockets—supplemented by a soothing and mildly astringent paste to use at home. These requirements are ideally combined in The FORHAN Method.
Forhan's Pyorrhea Preparation (paste) may be prescribed through druggists, but the liquid Forhan's Pyorrhea Astringent is on sale through Dental supply houses solely, and is sold ONLY TO DENTISTS—not to the public.
Actual size, Price $2
Forhan Company
25 Elm Street New York
Actual Size, Price 90 Cents

Fig. 3.—Advertisement in a dental journal about 1916. One wonders if Forhan's Pyorrhea Preparation for the Gums was the same preparation as Forhan's for the Gums.

"On the basis of the foregoing, a solution having the essential properties of Forhan's Pyorrhea Astringent can be prepared by dissolving: zinc chlorid (U. S. P.), 49.6 gm. (approximately 1.6 ounces); cobalt nitrate, hydrated, 1.4 gm. (approximately 21 grains); glycerin (U. S. P.), 18 c.c. (approximately 3/5 fluid ounces), hydrochloric acid, dilute (U. S. P.), 5 c.c. (approximately 1/6 fluid ounces) in sufficient water to make 100 c.c. (approximately 3 1/3 fluid ounces)."

One wonders how impressed the dentist would be if Forhan's Pyorrhea Astringent—"the formula of R. J. Forhan, D.D.S., a specialist in diseases of the mouth"—was given an informing and meaningful name. The Chemist's report indicates it to be approximately a 35 per cent solution of zinc chlorid in an aqueous-glycerin medium rendered pink by a dash of cobalt nitrate.

In the armamentarium of the dentist, zinc chlorid and certain preparations containing it have a place in a prescribed field. And as such, the practitioner should prescribe it and regulate the preparation of zinc chlorid according to the condition of the individual patient. But to use a preparation the composition of which is secret would indeed be poor defense in a suit of malpractice and can hardly be justified on scientific grounds.

It might be of interest to learn that an amount of material just as valuable as Forhan's Pyorrhea Astringent, which sells for $16, can be prepared for less than 50 cents, exclusive of overhead. Such a margin of profit is certainly tremendous, to say the least.

FORHAN'S FOR THE GUMS

If one is to believe the statement that the toothpaste, Forhan's for the Gums, is compounded with Forhan's Pyorrhea Astringent, this toothpaste would contain zinc chlorid and cobalt nitrate, among other things. There is no record that the daily use of a preparation containing an astringent such as zinc chlorid will prevent pyorrhea or help to protect teeth from decay. Thinking dentists do not allow themselves to be carried away with sales propaganda that rides on the back of misdirected "oral health education." The composition of the toothpaste, Forhan's for the Gums, and the claims made for it will be considered more in detail at a later date in connection with a general survey of dentifrices.

WARNING: Do not inject into tissues—See Directions.
Forhan's
PYORRHEA ASTRINGENT
in the treatment of PYORRHEA ALVEOLARIS.
Chronic Ulceration of the Gums, Pyorrhea Pockets,
SUPPURATING OR RECEDING GUMS.
FORMULA OF R. J. FORHAN, D.D.S. OF NEW YORK CITY.
A SPECIALIST IN DISEASES OF THE MOUTH.
Sold to the dental profession only through dental supply houses exclusively
PRICE, $2.00 NET
NET WT. 1/2 OUNCE
BY Forhan Co. INC. NEW YORK, N. Y.
DIRECTIONS
After all deposits have been removed from the roots of the teeth, carry preparation to the bottom of Pyorrhea Pockets with an abscess syringe, orange stick, or tooth-pick. Never inject with hypodermic syringe.
CAUTION
When pockets begin to heal by granulation, do not allow instrumentation to break down the adhesions. If you have patient rinse out mouth from time to time, while using the remedy, you will not have to protect the surrounding tissue in the mouth.
Prescribe Forhan's for the Gums (a tooth paste) as a help to your clear treatment. It will help you keep them after you discontinue your treatment.

Fig. 4.—Forhan's Pyorrhea Astringent to dentists; Forhan's Pyorrhea Liquid to the public. Is multiplicity of names conducive to rational therapy?

BUREAU OF DENTAL HEALTH EDUCATION

POSTGRADUATE COURSE IN CHILDREN'S DENTISTRY

By JOSEPH B. JENKINS. D.D.S., Oklahoma City, Okla.

CONSIDERABLE interest has been evinced by the dental world in the postgraduate course of instruction in children's dentistry recently completed in Oklahoma. It was not truly an experiment, since the plan had been pursued with great success in this state in its application to physicians and surgeons.

Briefly, the itinerant plan of postgraduate instruction as followed in this state is somewhat as follows: The state is divided into six geographic sections, and a city is selected as near the center of population as is possible in each section where the instruction is to be given. On consecutive days, the instructor appears at this central city and meets the class members at a given place, and the instruction is delivered to the group. The day following, he travels to the next central city, meets another group, gives the same lecture that was given the first day to the first group, and so on until he has completed the itinerary of the six cities in the six week days. The following week the same itinerary is covered, the instructor giving his second lecture or demonstration. This necessitates covering considerable distances for each lecture, amounting, in a six weeks' course, to as much as from 600 to 800 miles, and a greater distance is covered each week by the instructor.

Heretofore, the need of postgraduate study of the dentists was supplied by a method originated by Dr. Shobe of Tulsa, Okla., which has come to be known throughout the United States as "The Oklahoma Way." The annual meeting of the Oklahoma State Dental Society was conducted on the plan of organizing the membership into classes on various dental subjects, an instructor of ability and reputation being engaged to instruct the various classes for a period of one week of intensive study. The year following, the same subjects were offered, but the class membership alternated until every dentist had had from one to ten postgraduate courses of intensive study and clinical instruction in as many dental subjects, and without great expense and sacrifice of time. The fees ranged from $10 to as high as $50 per member, and required a loss of one week's time from the dental office. The instructors were well paid; they lived in comfortable surroundings. They were paid a specified sum for the week's instruction, and the residue was placed in the postgraduate fund of the state dental society. Courses in postgraduate instruction had been offered in practically all dental branches except pedodontia.

There are about 500 dentists in the state of Oklahoma, about 350 of whom are members of the state dental society. Under the annual society meeting plan, the postgraduate instruction was available only to these society members; and

thus many good ethical dentists who might have availed themselves of these advantages were denied them because of nonmembership in the state and American Dental associations.

There are in Oklahoma 700,000 school children in the grades alone. Surveys have shown that not less than 557,000 of these children are in need of both reparative and preventive dental service. The public health agencies of the state had been directing parents to take their children to their local dentist for any needed dental service. These agencies were very frequently met with the statement that the children had been taken to the dentist, and that he advised doing nothing, as the teeth were temporary and would soon be lost anyway. There was a general apathy throughout the state toward child dentistry, and it was all but entirely neglected in some sections.

It soon became evident that the next logical step in the child health program was the enlistment of the cooperation of the dentists themselves in doing such work for these children as was so much needed.

The public was ready for children's dentistry and asking for it; the public health agencies were advising that it be given attention; but it was found that the average dentist preferred not to work for the child patient because:

1. The average child dental patient is much more difficult to work for than an adult, as, having no pride or philosophy to support him through an ordeal, he proceeds to disturb the even routine of the office, often preventing the dentist's doing good work for him.

2. The patient's parents were generally of the opinion that it was not at all important that children's teeth be cared for, nor was it of enough importance to warrant an expenditure of money sufficient to pay a dentist for really conscientious effort to render good service.

3. He felt uncertain as to the results, and feared consequent injury to his professional reputation if results proved unsatisfactory.

4. Child dentistry was universally done at a financial loss to the dentist.

It became evident that a great need existed for a postgraduate course of instruction in pedodontia, since this branch of dental service required special training and ability to obtain best results, which, owing to the general pessimistic regard in which dentists held children's dentistry, they had not cared to develop.

In order to meet this need, Miss Pearl Wilson, director of dental health education in the state department of public health, in collaboration with Roy H. Ellis, now president of the Oklahoma State Dental Society, Paul L. Vogt, dean of the University of Oklahoma Extension Division, and his assistants and representatives developed the plan along the lines on which the university had established special courses for the medical profession, adapting it to the needs of the dental profession.

The plan was presented to the dentists over the state at their fall district meetings and was enthusiastically accepted. The time agreed on was for six weeks in November and December, 1928, owing to the fact that work is lighter in the offices of the dentists at that time than at any other time of the year, and more time would be available for attendance. Phillip Thomas of Minneapolis was selected to give the series of lectures, demonstrations and clinics. Dr. Thomas' reputation as an instructor and demonstrator, together with his dynamic personality, proved a powerful influence in drawing men into the project, as his work

and ability were well known in this state. The enrollment fee was set at $25.

Dr. Thomas' untimely death in November proved to be a powerful blow to the project, as the delay caused by the difficulty in finding a substitute for him caused the course to be given at a most unseasonable time of the year.

Thomas B. McCrum, of the Kansas City Public School Clinic, Kansas City, Mo., and Paul A. Barker, of Denver, Colo., two well-known pedodontists and nationally known instructors, were chosen to give the course. The instruction was completed, and the dentists have been interviewed by means of a uniform questionnaire, their replies being returned and tabulated. From these returned questionnaires, answers are compiled relating to the most outstanding reactions and conclusions relating to the course.

It was desired to determine of each dentist whether (1) he thought the recent plan had been a success; (2) the instructors were satisfactory; (3) he had derived any definite knowledge which he is using in his practice; (4) it had been worth the cost in time and money; (5) it had improved his practice to take the course, and if so, in what way; (6) the fee was considered too large or too small; (7) this plan was considered more convenient than the former postgraduate plan of study; (8) he would enroll in another course of acceptable nature if it were offered. Further, he was asked what season of the year would be considered best for the course, and what subjects were preferred.

To the first question, "Do you consider the recent postgraduate course a success?" the almost unanimous reply was "Yes."

To the third question, "Did you derive any definite knowledge which you are using or can use in your practice?" the reply was an almost unanimous "Yes."

To the fifth question, "Has the course helped to improve your practice?" all but three answered "Yes." The answers to the second section of the question, "In what way?" were most illuminating and gratifying. Following are some of the replies:

"It gave me a broader conception of the needs and possibilities of child dentistry."

"I have made space retainers that would have otherwise been neglected."

"It has broadened my VISION of the needs of children's dentistry."

"It was a good project. I believe the publicity received was worth the expense."

"By strengthening the public confidence in me. I traveled ninety miles each week to get this course, and will take the next one offered if at all possible."

"Showed me how to do better children's dentistry."

"Helped me understand more thoroughly its needs, and render better service to the child. Less convenient to the out-of-town dentist."

"Would have preferred more on subject of dietetics, etc. Parents know I took the course and are bringing their children to me."

"Helped me to handle my little patients better, render them better service and at a better fee."

"It has caused me to talk more child dentistry, thereby rendering a greater service to humanity."

"I am giving my child patients better service, and getting a fee worth my service. Would like to see the same course repeated with more clinics and less papers and pictures."

"Can discuss children's dentistry so much more intelligently with the parents, and know it is helping me a great deal."

"Course should be held in the fall, the course completed in each center, and then move on to the next center."

"Good project, publicity was greatest benefit received."

"I cannot say that it helped me."

"Do not think it has improved my practice."

"Helped me by standardizing a definite method of handling certain cases. Clinical work with lectures would help."

"I handle children and their mothers with more confidence. Course worth more to me, but doubt if class could be enrolled on a larger fee."

"The new technic of both operative and child management were most valuable. Am doing better child dentistry, improved my management of deciduous molars and served to standardize and establish definite UNIFORM methods in given cases."

"I am doing much work heretofore left undone, educating the parents to the need of the service."

"Parents know that I took the course and are bringing their children in for service. Would like to see the same course repeated. It has changed my attitude toward child dentistry."

In reply to the sixth question, two-thirds of the replies were to the effect that the fee was satisfactory.

Seventy-five percent of the replies agreed that the plan was more convenient than the old one-week plan. There was an almost unanimous agreement to enroll for the next course offered if the time, the subject, the fee and the instructor were satisfactory, the majority expressing a preference for the fall season.

The preference of subjects ran through the entire list of dental subjects, office management, dental economics and child psychology. The three leading preferences were, in the order given: oral surgery and exodontia; prosthetics and operative dentistry; crowns and bridgework.

The intention to draw the nonassociation ethical, eligible dentists of the state into the postgraduate work was a failure, in that not one dentist outside the Association took the course.

Had the course been offered at the regular one-week postgraduate annual meeting, probably not six men would have enrolled; whereas, eighty-six men took the course under the present plan.

The dentists in the remote localities, for whose convenience the course was primarily designed, were unanimous in their opinion that the plan was less convenient than the old one-week plan, though it requires much less loss of time from practice. The lecturers agreed that the plan works a much greater hardship on them in the expenditure of energy, time and effort, than the one-week plan.

A great advantage of the itinerant plan of postgraduate instruction is that the three hour lectures are interspersed with one week of practical application, reflection, absorption and appropriation of the ideas gained.

The course would have been accounted a successful project if it had accomplished no more than to stimulate an interest in child dentistry, and standardize the service to children, so that dentists will tell the same story to the parents, and, since their duties, responsibilities and possibilities have been pointed out to them in this course, follow the same procedure. The dentists developed a "child teeth consciousness" which never before existed. It is to be hoped that in the future,

when parents present a child requiring dental service, the dentist will either render this service, or frankly tell the parents that he does not care to do this type of work himself, but will be glad to refer them to someone else who is temperamentally fitted, and qualified by training, to render the service that they have a right to expect from the dental profession.

RADIO TALK*

By J. B. SHERMAN, D.D.S., Chicago, Ill.

SOMETIMES I think that I probably do not make these talks human enough, but I have always tried not to bore you with a mass of technical terms, and sometimes I imagine I can see you tuning me out especially if you have just had considerable dental work done. But I believe that if you do not hear something that will be of special benefit to yourself, you will hear something that will be of value to your children.

You remember that I last spoke of the wonderful work that was being done in the school clinics, and how at least 3,400 children would be able to enjoy their vacations as they never have enjoyed them before; so now you see I am starting off on that pleasant subject, vacation. I do hope you parents have been able to enjoy a vacation with the children, for—

If your nose is close to the grindstone rough,
And you hold it down there long enough,
In time you'll say there's no such thing,
As brooks that babble and birds that sing;
These three will all your world compose,
Just you, the stone, and your darned old nose.

And now to show you what a little vacation can do, Dr. Edward Bachfield says—

But if you turn your tear dimmed eye
Upward and look to the starry sky,
Seeking for joy in the rustling trees,
The singing birds and the humming bees,
Love and laughter and sweet compose
Will soon replace that darned old nose.

I know you have all heard of preventive dentistry a great many times, and when I see so many children's mouths in such a deplorable condition, I sometimes think that a great many parents believe that preventive dentistry means preventing the child from having any dental work done. Now just what is preventive dentistry? It may be defined as being any measures that are undertaken coincident to the formation, eruption and retention of the teeth and that will lessen their liability to decay. We stand on the threshold of a great preventive campaign which marks an epoch in the history of the dental profession. It has been slow in coming, but it was predicted as far back as 1911 when Evaline Wright Nelson said (rather pessimistically perhaps, but it sounded a warning and a challenge to the science of dentistry):

The world has gone wrong in ways physical, mental, spiritual and social. Giant Greathearts ache with the burden of trying to restore man to his lost estate; unwilling to abate energy in this redemptive scheme, their agonized cry is Prevent! Prevent! Well they know that prevention actions hold the larger hope, be it against poverty, tuberculosis or other disease—capture the untainted, the children and save them from a state requiring reformation.

*Broadcast from station WBBM, Chicago, Ill., Aug. 23, 1929.

You will remember that I said in my last talk that a preventive program was made up of three measures, each measure being closely associated with and indispensable to the others. The three essentials are: 1. Prevent disease to which the oral cavity is a prey by the formation of sound teeth; that is, through prenatal feeding. 2. Correct the diet of the child to insure these sound teeth. 3. Maintain a strict mouth hygiene program as a matter of prevention.

Now, in regard to the first essential: It is quite plainly to be seen that prenatal feeding will not be entirely successful, and the child will stand less chance of being sound in bone and tooth structure if the mouth of the expectant mother is in an unhygienic condition. Contrary to popular belief, this is the time of all times when her mouth should receive careful attention. There are several theories advanced as to the cause of the breaking down of tooth structure during pregnancy, but we do know that, at this period, the vitality of the mother is considerably lower and tooth structure more readily succumbs to these disturbances which bring about decay. We know that for the mother to carry any infection at this period is an extra burden on her lowered vitality, and it is a good policy to have the teeth examined by roentgen ray so that steps can be taken to remove any infection that might be a drain on the vitality. She should be very conscientious about brushing her teeth and gums, and two or three times a week, it is well to rub milk of magnesia about the necks of the teeth and in between the teeth. This will have a tendency to counteract the acid condition of the mouth, and allay any undue sensitiveness about the necks of the teeth. Aching of the teeth has a harmful effect on the nervous system of the mother. These teeth can be taken care of without any undue punishment, which will relieve her of that strain and make it possible for her to masticate her food properly, both for her own good and for the good of the child.

And now in regard to the regulation of the diet to insure these sound teeth: I know that a great many of you mothers will throw up your hands in despair when we talk about what the child should eat, and what he should not eat. It is quite simple. Start feeding him the right foods, and he will have no desire for the things he should not have. He does not inherit his desire for excessive sweets from his Daddy: he cultivates that appetite by overindulgence. Now that he is started correctly, by close supervision he can be kept on the proper diet. This is not easy—it must become a sort of hobby with you. Day before yesterday, I had occasion to see the 4½ year old son of a dentist friend of mine. His diet is and has been closely supervised, even to the rationing out of sweets. Physically, he is a perfect specimen of boyhood, mentally alert. Examination of his mouth disclosed twenty beautiful baby teeth, the grooves perfectly formed and not a sign of even a pit cavity; one of Nature's masterpieces done in miniature. But, you will say, he is the son of a dentist and should have advantage of the necessary knowledge. You parents have access to this knowledge through your family dentist, physician or the board of health, so that you can know the proper food for the child during the different stages of his development.

As a rule, figures are not very interesting unless they point out something of special interest to you, so let us look over a report of the last five months of dental work performed in the school clinics, to see what was accomplished and what it really means. Attention was

given 14,966 children. What does that mean? It means that 14,966 unfortunate children received dental care who would otherwise have gone on with unhygienic mouths, harboring infection which is a detriment to their general health and welfare. Out of this great number of children, there were only ninety-seven denied treatment, and these were denied on account of either the parents' attitude or an unwillingness on the part of the child to submit to treatment. So you see the children themselves really want this service.

Fillings inserted numbered 20,401, 14,331 of which were alloy or silver. What does that mean? It means that there are 20,401 more comfortable teeth, which can properly masticate the food so necessary to the health and growth of the child, and which, by virtue of their being kept in the mouth, will influence, to a great extent, the proper eruption and alinement of the permanent teeth.

The baby or deciduous teeth extracted numbered 8,326, a very large percentage of which were positive sources of infection. What does that mean? It means that we stopped the flow of infection to other vital parts in that many channels. Attention was concentrated on the first permanent molars, with the result that a great many of them were saved that would have been lost by the time school was resumed this fall. And now in addition to these splendid results, and on account of the activity of the educational division of the dental hygiene bureau of the department of health, 12,827 children were led to seek the services of a private practitioner. So you see at least 27,000 children were benefited directly and indirectly by this short but intensive program. According to present plans, the bureau will be in operation again this fall, and we ask your earnest cooperation and moral support.

OUR CHILDREN'S TEETH*

By CORVIN F. STINE, D.D.S., Evanston, Ill.

IN the care of children's teeth, it must be readily understood that the teeth are an integral part of that whole mechanism, which we call the body. If we fail to realize this, it will be very hard to understand the relation existing between disease of the teeth and disease of other parts of the body. Remember that the teeth receive their nourishment through the blood. The same system that supplies blood to the teeth supplies blood to every other part of the body. The nerves supplying impulses to the teeth are the same type of nerves that supply impulses to the other parts of the body. These nerves are a part of the whole nervous system which supplies the entire body. The bone which supports and retains the teeth is the same kind of bone which makes up the rest of our body and is a part of the skeleton. The teeth then are not a separate and distinct part of the body that can exist alone, but is an integral part that needs the aid and help of the rest of the body in order to function properly.

*A radio talk broadcast over WBBM, Chicago, Ill., Feb. 12, 1929.

The foundation for good sound teeth is laid long before the child is born. Six months before birth, the first teeth begin to form. At birth, the first set of teeth is nearly completely formed, and one-fifth of the crown portion of the first permanent tooth to erupt is formed. The first step, then, for good teeth in our children is to see that the expectant mother has the proper care and diet. The formation of all these teeth demands large quantities of mineral salts. The minerals may be found in whole milk, butter, cheese, fresh fruits of all kinds and green vegetables, such as spinach, raw cabbage, lettuce, green beans, carrots, celery and turnips. Plenty of fresh air and sunlight, proper and limited exercise, sufficient rest, proper bathing and hygienic care are all necessary for normal tooth conditions.

When the child attains an age at which the diet of milk is supplemented by that of solid foods, Nature provides teeth with which to prepare this food for the stomach. The first baby tooth usually erupts between the sixth and ninth month and the last one at about 2 years of age. By 2½ years all the teeth of the baby set should be through the gums and in their correct positions. This set will consist of twenty teeth which are usually white and regular in arrangement. There will be no noticeable change in these teeth for several years. Then spaces will form between them owing to the growth and expansion of the jaws, to accommodate the larger permanent teeth.

During the period of approximately four years from the time the last baby tooth comes through the gums to the eruption of the first permanent tooth, the process of manufacturing the permanent teeth has been going on and will continue on throughout childhood. To develop these teeth properly, the child should have whole milk, fresh fruits and vegetables, as mentioned before, a morning cereal and a small portion of meat once a day. Candy should be had only at meal time and then only in small amounts. Nothing should be eaten between meals; but if it is done, substitute an apple or an orange for the sweets.

The question is often asked, Should the baby teeth be filled when cavities are discovered in them? It is extremely important that they be cared for immediately:

1. Because they are needed to chew the food properly so that the delicate stomach will not be overburdened.

2. To prevent the teeth from abscessing and causing infections to get into the blood and subject the child to heart, kidney, lung trouble, or rheumatism or some other disease of this nature.

3. In order to eliminate an ideal breeding place for many germs, especially those causing pneumonia, measles, scarlet fever and diphtheria.

4. To help the child to talk properly and to prevent any impediments in speech that might become a habit.

5. Because, by filling the first set of teeth, the correct space is preserved in the dental arches, and the permanent teeth erupt correctly and are not irregular.

6. Because the normal retention of the baby teeth will aid in the proper development of the jaws and facial expression.

7. To prevent decayed surfaces of the baby teeth from coming in contact with the new erupting permanent teeth, which would cause the formation of a cavity in the second tooth.

8. To prevent pain and suffering and to promote health and happiness.

The first permanent tooth to erupt is the first permanent molar. It is sometimes called the keystone to the dental

arch because of its importance in determining the arrangement of the permanent teeth. It erupts back of the first teeth and does not replace any of them. It is the sixth tooth in counting from the middle of the anterior teeth and can be so determined. Even though it is the largest tooth in the mouth, it usually erupts without any pain or discomfort and often unknown to both child and parent. For this reason many times it does not receive such good care as it might otherwise receive. During that period when the first set of teeth is being replaced by the permanent set, the first permanent molar keeps the two jaws in proper relation as well as carrying the burden of the work of two other teeth. This tooth is the most neglected, most often decayed, and most frequently lost, of all the permanent teeth. According to statistics, one year after eruption, in 15 per cent of children one or more of these teeth need attention.

The question then arises: When should children's teeth be given attention, both at home and at the dental office? The teeth should be brushed or cleaned as soon as they are through the gums. A small brush should be used by the parent until the child has reached the age when it can properly do the work itself. The child's first visit to the dentist should be between 2 and 2½ years and should be followed by regular periodical appointments that never should exceed six months. In this manner, the dentist will be given the opportunity to make a friend and confident of the child, and to prevent rather than fill cavities.

The mouth is the gateway to the body. Through it, all food must pass, whether in the liquid or in the solid state. Clean food and clean dishes are demanded by all, but many times the condition of the teeth is either overlooked or neglected. Is it logical, then, to take all these precautions, and, at the last stage, mix this clean food with the decaying and decomposing food material found both on the surfaces and in the cavities of the teeth? This decaying material is alive with germs which are then introduced into the stomach.

By proper brushing, the materials lodging on the surfaces of the teeth can be removed. A simple rule to determine the correct manner to brush the teeth is to remember always to brush the gums over the teeth. Then, if you are brushing the upper teeth, the movement of the brush will be downward over the gums and teeth. If the lower teeth are being brushed, the movement of the brush will be upward over the gums and teeth. The biting surfaces of the teeth should be brushed in all directions because of the cracks and fissures on these surfaces that run in all directions. The roof of the mouth, the cheeks, the tongue and the gums should be included in this procedure. If the teeth are brushed but once a day, that time should be just before retiring and should consume a period of five minutes by the clock. If the teeth are to be brushed twice a day, they should be brushed after breakfast. If they are to be brushed three times a day, brushing after the noon meal should be added. The ideal, of course, is brushing after each time that food is eaten, and before retiring. So, to all the little children, please remember:

Before I lay me down to sleep,
Each night I'll brush my teeth,
I'll brush the front, I'll brush the back,
I'll brush on top and underneath.

Each morning, when I awake,
Again my little brush I'll take,
A thorough brushing to repeat,
To keep my mouth clean and sweet.

At least twice, in each year,
Before my dentist I'll appear,
Resolved to follow his advice,
And keep my teeth polished nice.

CARE OF THE CHILD'S TEETH

By CARL D. BATES, D.D.S., Chicago, Ill.

THE baby teeth, which we speak of as the temporary or deciduous teeth, are in reality in a temporary environment, because the baby's mouth is changing and developing until it reaches maturity.

The child at 3 years of age has twenty deciduous teeth. These teeth are present for varying periods up to 12 years of age, when normally the last of the temporary teeth should be lost. The fact that these teeth are going to stay with the child for as many years as they do makes it quite necessary to exert every effort to keep them as healthy and free from decay as possible.

Every day, you hear some mother say that there is no use bothering with these baby teeth because they are going to be lost anyway. What a fallacy this is! These teeth are the organs that are going to prepare all of this child's food for its reception in the stomach.

These teeth also are holding the space in the mouth until the permanent teeth are ready to come into place. Do you realize that every tooth has a direct bearing on the position in the mouth that the permanent tooth which replaces it will take? If a tooth has to be extracted before the time for the permanent tooth which follows it to erupt, the teeth on either side frequently move closer together, decreasing the space that was formerly occupied by the baby tooth which has been lost, and thereby making it much more difficult for the permanent tooth to come into natural alinement.

You have all seen mouths in which teeth were very crowded and one tooth stood out in front of another because the second tooth did not have sufficient room to come in straight. Perhaps some of you have this condition in your own mouth, and have been embarrassed by it.

Just think what it will mean to the child when it grows up to have a beautiful, clean, regular set of teeth. No one fails to notice the smile of the girl whose teeth are regular and even. Her teeth readily become a great asset to her, and many of us form our first impressions of people by their appearance.

How, then, are we going to preserve these temporary teeth and keep them from decay until the permanent teeth come into place? It is only by the routine supervision of the parent in seeing that the child is so instructed in the employment of the toothbrush and dentifrice that their use will be the natural thing in its life.

What is it that this toothbrush and dentifrice do that aid in preserving the teeth? The brush mechanically removes food particles on the surface of the teeth and from the surface between the teeth. The dentifrice assists in removing these food particles and the film deposited from the secretions in the mouth, a rôle like that which soap plays in the cleansing of the hands. It keeps the enamel of the teeth so smooth and polished that film

*A radio talk broadcast over WBBM, Chicago, Ill., Jan. 29, 1929.

and deposits do not readily adhere to their surface. It is very important that the child should brush its teeth after each meal. Especially is it important after breakfast and in the evening before retiring, because of the fact that, in the diet of the child, cereals play an important part, and many of the cereals contain a high percentage of starches, which are readily converted into sugars by the action of the saliva and digestive juices and, when kept in contact with the enamel for long periods, gradually cause decay of the teeth.

The brushing of the teeth in childhood should start as soon as the teeth erupt. The mother herself starts the brushing until such time as the child is able to handle a brush by itself, and then the brushing should be carried out under supervision.

The supervision of the child's mouth, of course, should not be limited to the parent's supervising the brushing of the teeth, but should be followed up by frequent inspection of the child's mouth, to assure that the teeth are really clean and that no decay has been allowed to start. The parent should be able to detect early decay of the teeth and should see that the child is immediately taken to the family dentist.

"When should the child first visit the dentist?" is a question that is frequently asked, and the best answer that I could give is that the child should be taken to the dentist at 3 years of age. This may seem very early to many who have waited for the child to complain with an aching tooth before rushing to the dentist, but you all know that we are living in an age when all means are taken to prevent disease before it actually occurs.

In business, we do not wait until a fire has started before we take out fire insurance or install fire extinguishers.

The loss of business, as well as the damage incurred, means too much to take any chances. Why, then, should we take a chance with the most precious thing that we have in life—our own bodies and the bodies of those dependent on us? Should we dare risk affecting the health and lives of our children by neglect? You will all answer no. This early visit to the dentist when there is little to be done other than to examine and advise is a great help to a child. They learn to have confidence in the dentist because they are not hurt. He is going to make every effort to preserve the baby teeth and keep them comfortable and useful. If he has the spirit of the times, he will arrange for you to have the child come to his office at regular intervals to see that no spot of decay has started in the teeth. If the examination is made in this way, any decay that does start can be quickly detected and a very small filling inserted that will not give the patient any discomfort.

The reason that so many children fear to go to their family dentist is that the parent has waited until the tooth has decayed so badly that the nerve is either exposed or nearly so. Of course, any work on such a tooth will not be pleasant, and if children start with unpleasant impressions of the dentist, it will be much harder to get them to visit him later on, and frequently they will not speak or complain of a mildly aching tooth for fear it may mean a visit to the dentist. Thus, they make a bad matter worse.

At these early visits, the dentist is able to supplement the home care in the cleaning of the teeth, and he can remove stains and deposits which the child has been unable to remove with the toothbrush. The modern dentist plays a big part in the field of health service by educating his patients as to how to care for their

teeth. The little child is instructed in the latest scientific method of brushing the teeth and goes home ready to follow these instructions daily.

Besides the brushing and routine mechanical care of the teeth and gums, we have several other factors to consider in the preservation of a healthy set of teeth.

The decay of teeth occurs in several ways. First, we have the decay that occurs as a result of leaving food materials about the teeth. The decomposition and fermentation of this food in the mouth form acids which attack the enamel and gradually destroy this hard protective coating, usually at a point between the teeth or in the deep crevices on the biting surface. This local effect of acids on the teeth is very common when the diet consists of large quantities of starches and sugars. Another cause for decay of teeth is from within the body, from the lack of tooth-forming elements in the diet. The teeth are built up from materials carried to them by the blood, and if there is a lack of lime and phosphorus in the diet, the teeth are of improper structure, and of course this would make them more susceptible to decay when there is local acid or uncleanliness in the mouth.

Exercise and sunlight, we now know, play an important part in the nutrition of the child. The more sunlight that the child is exposed to, the better the fixation of the lime salts in the child's teeth and bones; that is, the mechanical factor. When fruits and vegetables and coarse cereals are incorporated in the diet, these act mechanically on the teeth and tend to brush or clean the surface of the teeth that are biting through these foods. They also stimulate the gums by the massage which the chewing of this food exerts on the gums, thus helping the circulation in the gums.

Aside from the mechanical brushing of the teeth by the food, we find that when the teeth have definite work to do in chewing firm substances, the jawbones and gums develop much better. Did you ever notice how any part of the body that had no work to do shrivels up? The same is true of the supporting structure of the teeth. It is, therefore advisable to incorporate in the diet of the child many hard, coarse and chewy foods, such as toast and crusts of bread, especially whole wheat and rye bread, and uncooked vegetables.

The importance of the care of children's teeth is very evident when we realize that a mouth full of decayed teeth and inflamed unhealthy gums renders the child more susceptible to the contraction of the contagious diseases of childhood than a child with a clean healthy mouth. We can readily understand that when cavities are present, holding quantities of decayed food material, these act as excellent breeding places for any bacteria and other germs which the child may pick up at school or from contact with its playmates.

Some years ago, an orphan asylum in Massachusetts, which harbored about 300 children, employed a dentist to examine and repair the teeth of all its children. There had been a great deal of trouble with contagious diseases up to this time, but one year after this work was taken up, the records showed that the cases of contagious diseases were reduced to less than one half. At the end of three years, there was a very small percentage of contagious diseases in the institution.

Children today are eating candies and sweets and less coarse foods, vegetables and fruits. This should be corrected by reducing the amount of sweets and refined foods and increasing the amounts

of fruits, vegetables and milk. In addition to this, they should exercise freely in the open air and sunlight. Thus, they will increase the health of their bodies, as well as improve the structure of their teeth and bones, improving very much the prospect for a healthier and happier next generation.

SELECTION AND CARE OF THE TOOTHBRUSH*

By BERNARD D. FRIEDMAN, D.D.S., Chicago, Ill.

IF we were living in the Stone Age, we probably would have no use for a toothbrush. The foods that were popular then were of a very simple variety. They were hard and coarse and vigorous chewing was required to prepare them for swallowing. This vigorous chewing, or mastication as we call it today, helped to keep the teeth clean and stimulated the flow of the saliva in the mouth. The increased amount of saliva assisted in washing the teeth and inside of the mouth and aided in swallowing and digestion. Saliva, as you all know, is the fluid that is always present in the mouth and whose job it is to prepare the food for the stomach and keep the teeth clean.

With modern progress has come soft foods, predigested foods and sweets of all kinds. These foods are mixed with the saliva and make it thick and sticky. This sticky mass attaches itself to the teeth, and to remove it we must use a toothbrush. If this mass is allowed to remain in the mouth, it forms a film over the teeth, which causes fermentation and consequent decay of the teeth. A clean tooth rarely decays, and in order to have clean teeth and keep them clean, we must use a toothbrush.

It would be a nice arrangement if every child were born with a toothbrush in its hand: a nice tiny little brush to fit its mouth and its teeth when they come; a brush that would grow as the child grows. But as Nature has not seen fit to supply us with a toothbrush to carry through life, it is necessary for us to select one from time to time that will fill our requirements at that time.

For the child of two and a half years, the age at which toothbrushing should begin, select a suitable baby brush. This brush should have a strong firm handle and a single row of five or six tufts of medium hard bristles. As the child grows and reaches school age, a junior brush should be used, which is similar to the baby brush except that it has two rows of five or six tufts instead of one. When the child outgrows this brush, a youth's size brush should be used. This brush is similar to the adult brush, which I will describe later, except that it is slightly smaller. These brushes are all standard size, as we assume that up to this age, that is, 14 to 16 years, the child has all its permanent teeth.

Now as we come to the selection of the toothbrush for the adult, certain things must be taken into consideration. In the cases in which a mouth deviates from the normal and certain irregularities appear, these irregularities must be considered in

*Radio talk broadcast from WBBM, Chicago, Ill., Feb. 26, 1929.

the selection of a toothbrush. Certain teeth may have been lost prematurely and have not been replaced. Certain repairs may have been made in the mouth. Certain lost members of the dental arch may have been replaced by bridgework or plates. Each adult requires a toothbrush to fit his or her case.

For the average normal adult mouth, a straight backed large handled brush with two rows of six, seven or eight tufts of the hardest bristle obtainable is the ideal instrument with which to brush the teeth.

If the adult has teeth which are soft and brittle, a medium hard bristle is recommended. A soft bristle brush is of little value and should never be used.

The point to be remembered is that a clean tooth rarely decays. In order to make a tooth clean so that it will not decay, every surface of the tooth must be brushed. If any of that sticky film which is present in every mouth in this day of soft food, too rapid eating and too little chewing is allowed to remain on any surface, it invites fermentation and decay. So determine the shape, size and irregularities in your mouth and then select a toothbrush with which you can brush every surface of every tooth in your mouth. In some cases, a brush with an elongated tuft of bristles at the tip is indicated. Sometimes, a brush with but four rows of bristles is indicated. Sometimes the bristle must be cut down or trimmed to fit certain irregularities. A brush with more than eight rows of bristles is too large for the average mouth and interferes with the successful brushing of certain surfaces of the teeth. The tufts should not be too close together, for the same reason. Be sure to see that the brush which you select has a strong broad handle, as, in some cases, it is necessary to use considerable pressure to reach certain surfaces of the teeth.

This is the age of specialization. No matter what we require in our daily existence, we go to a specialist for it. Your dentist is a specialist in the care of the mouth and teeth. What is more logical than to have him prescribe the proper toothbrush for your individual case? He examines your mouth at least every six months and is surely in a better position to know and understand your requirements than the man who just sells you the brush and has never looked into your mouth.

When your dentist has determined the type of toothbrush that you require, select two of them: one to be used in the morning and one at night. When there are several members in your household and you desire to select the same make of toothbrush for each one, you may do so without fear of getting them mixed by selecting a brush which has a letter of the alphabet stamped on its handle for purposes of identification.

Keep each brush in a separate container. These toothbrush containers may be of glass, celluloid, aluminum or rubber, and should have airholes at one end at least. Before using the new brush, pour boiling water over the bristles for several minutes. Shake the excess water off and sprinkle table salt on the bristles. Place the brush in the container and put it away until you are ready to use it. It is a good plan to keep a small salt-shaker filled with table salt in the bathroom cabinet, and each time after you have finished brushing your teeth and have thoroughly rinsed the bristles by pouring boiling water over them, shake off the excess water and sprinkle the bristles freely with the salt. This procedure dries the bristles and hardens them so that you have a fresh stiff-bristled brush to

begin your brushing the next time. When the bristles become so soft that you cannot force them in between the teeth, they, the bristles, have lost their vitality and a new brush should be procured.

There are special brushes made with which to clean removable bridgework and plates. These are called dental plate brushes. Never use your toothbrush for this purpose. Always remove these dentures before commencing to brush your teeth.

In conclusion, I want to impress on you again the importance of a clean mouth. Clean teeth make a clean mouth and a clean tooth rarely decays. The best means that we have to clean teeth today is a good toothbrush with a suitable powder or paste. In selecting your toothbrush, give the matter your careful consideration.

Visit your dentist at least twice a year, and let him prescribe the type of toothbrush that you should use to get the best results.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Ethylene: Its Comparative Safety: Report is made by Salzer (*J. A. M. A.*, June 22, 1929) of the results of a questionnaire sent out by the Jewish Hospital of Cincinnati in an effort to offset the prejudice that arose against ethylene after the explosion at Evansville, Ind., which was attributed to its use. A similar occurrence, the author declares, with modern equipment is impossible. "No explosion can possibly occur in the ethylene tanks themselves or in the tubing leading to the anesthetic machine, as only pure ethylene is present in this part of the apparatus. If a flame or spark were brought to a possible leak of this part of the apparatus, the gas would ignite but would not explode. After ethylene reaches the anesthetic machine any mixture of air, oxygen, ethylene and ether is possible. This mixture may be explosive or not; if it should be explosive and should be ignited, considerable injury, such as a ruptured lung or a severe burn, might be done to the patient; but it is almost impossible to conceive of any appreciable injury to the surgeon, anesthetist or any bystander, as the amount of gas that can be exploded is not under pressure and is less than one-eighth cubic foot in every machine on the market. This also includes the mixture in the immediate vicinity of the mask. When ethylene explodes it blows itself out, while when ether explodes it may throw liquid fire all over the operating room." The percentage of gas used to atmosphere in the average operating room is 0.3, which is too lean a mixture to explode. The entire tank contents gives only a percentage of 3 to 3.5, still too lean for an explosion to result. The questionnaire was sent to 478 hospitals of a bed capacity of 200 or more, and 132 stated that they made a practice of using ethylene. Replies were based on at least 425,000 administrations of ethylene. Only ten explosions were reported, or one in 42,000, a record that ether cannot approach. Explosions or flashes were responsible for three minor injuries, four cases of destruction of equipment and one death, the result of explosion of the lungs. The author cites two cases of death from a similar cause when ether alone was used. All except three of the hospitals where accidents have occurred are still using ethylene. The author concludes that ethylene is safer than ether.

Agranulocytic Angina: Three cases of agranulocytic angina, one fatal, are reported by Askey (*California and West. Med.*, July, 1929), all occurring in middle aged, undernourished women in relatively poor health. This and other very recent reports disprove the earlier belief that the condition is invariably fatal. In the first cases here reported, in a woman aged 41, epinephrin, 10

minims, was given hypodermically as a forlorn hope, in an effort to stimulate the bone marrow. For a week, improvement was so marked that it appeared that the patient was recovering. There was then a recurrence of the condition, and death ensued in about two months. There had been no response to liver therapy and two transfusions, given late in the case. In the second case, in a woman aged 51, the presence of a grayish spotted membrane on both tonsils, aphthous-like ulcers on the roof of the mouth and marked reduction of granulocytes led to the diagnosis. After a period in bed, in which improvement was slow and varied, the tonsils were removed. The patient feels fairly well, but her strength has not returned to normal. The third patient, aged 46, had had repeated attacks of tonsillitis. The attack that brought her to the hospital began with high fever, muscular pains, sore throat and intense swelling of the gums. Blood count showed no granulocytes. A smear from the gums and throat revealed numerous Vincent's spirochetes and fusiform bacilli. It was one week before any granulocytes could be found. Because of the uniform fatality of cases reported previously, there was little choice of therapy. Leukocyte extract was given in the hope of stimulating the bone marrow. Improvement was rapid and steady. The patient has been able to go on with her work as private secretary although her health is not up to normal. Smears from the gums have continued to show Vincent's spirochetes in spite of treatment. The author concludes that agranulocytic angina is probably a symptom complex belonging in the same category as aplastic anemia, and that it may be idiopathic or secondary to a known poison.

Pulmonary Lesions Secondary to Dental Caries: A young woman was said to have pulmonary tuberculosis on the basis of the repeated finding of acid-fast organisms in the sputum over several years' time. This patient's condition was considered hopeless because the roentgenogram revealed only a part of one lung aerated, and disseminated suppurative bronchitis was present. She has been bedfast for two years. Repeated examination of the sputum failed to reveal tubercle bacilli. Streptococci were found in abundance. Toothache had preceded her last attack, and the roentgenogram gave evidence of focal periapical disease, which was confirmed on extraction of the teeth. Multiple pockets of pus in the chest were drained by repeated paracentesis and she made a complete recovery. The second case was diagnosed as influenza, then right maxillary sinusitis, then spreading right-sided encephalitis and finally right-sided lung abscess. The patient was elderly. All of her teeth had been removed ten years previous to this illness. For some time preceding the onset of her illness, she had had a sore gum. The roentgenogram revealed a tooth fragment with a surrounding region of rarefaction. The tooth fragment was removed, the lung abscess drained through a bronchus, and the patient made a complete recovery.—Albert S. Welch, in *J. A. M. A.*, July 20, 1929.

Rheumatism: The possible association between focal infection and systemic disease is a question that has been very fully discussed, but which is nevertheless constantly giving rise to further discussion. It is not surprising that this association of pathological conditions should arouse such interest when it is realized how many members of the profession, each intent upon his particular sphere of action, are constantly reminded of it in one way or another, either by local or general manifestations. Every specialist is constantly meeting with focal infective lesions, whether these are situated in the mouth, the nasopharynx, the skin, the accessory sinuses or the genito-urinary tract. The operating surgeon meets many similar conditions: for example, in the appendix; whilst the attention of the general physician is directed more towards the systemic effects that such focal lesions are liable to produce. Amongst those general systemic conditions which depend upon focal infection, rheumatism is one of the more important; and in view of the frequency with which sepsis in the mouth and surrounding parts is associated therewith, it is of interest to the dental profession to consider all the suggestions that are put forward by those who view the situation from the medical point of view. In this connection a paper recently read by Dr. Graham-Bonnalie contains much that is of considerable interest. In a series of fifty consecutive cases he had endeavored to establish some definite relationship between signs and symptoms on the one hand, and pathological findings on the other but with little success. He regards *Streptococcus viridans* as the most frequent organism isolated in rheumatic cases, whether the focus be in the teeth, the tonsils or the alimentary tracts. He does

not consider oral infection to be a frequent direct cause of rheumatism; the importance of oral sepsis, in his opinion, is as a cause of secondary infection in tonsil or digestive tract, with subsequent production of rheumatism. The possibility of the presence in the same individual of more than one focus of infection is a point that is occasionally lost sight of. One is rather inclined, when one focus has been discovered, to feel that the end has been reached, and that there is nothing further to be done except to eradicate that focus. Whilst all will agree that once a focus has been discovered it should be effectively dealt with, it is important at the same time to bear in mind that the discovery of one focus of infection is no evidence that no other foci exist in other parts of the body. Several cases are mentioned in the paper above referred to, where the same organism was isolated from the tonsils, from the mouth and from the bowel. These cases responded to the action of vaccines prepared from organisms isolated from the bowel. Where multiple foci of infection exist, as in the cases referred to, the discovery and successful treatment of one of them, while the others were left undiscovered, or at least untreated, may have no beneficial effect whatever upon the general condition. It would seem clear, therefore, that every case of general systemic disease which may depend upon some local infective cause requires exhaustive investigation of every possible source of infection; and that such investigation cannot be regarded as completed, until every possible avenue in which sepsis may lurk has been explored, and, if necessary, dealt with.—*Dental Surgeon,* Aug. 3, 1929.

New Researches on Alveolodental Pyorrhea: René Vincent has recently given a rather new explanation of alveolodental pyorrhea, and the therapeutic results to which it has given rise seem to justify a certain measure of recognition. He states that, in the gums, particularly in the region of the interdental "bridges," there is a kind of lymphoid tissue similar to that of the tonsils and the appendix. This tissue, he explains, serves as a sort of excretory organ of micro-organisms. The micro-organisms thus eliminated come from distant foci of infection, often located in the intestine. Having been carried to the region of the gums, they set up an inflammation, and this causes the localized necrosis of the maxillary bone and the fetid suppurations that are characteristic of pyorrhea. As a practical deduction of this mode of thinking, Vincent recommends ascertaining, in the blood taken from the region of the gums, what micro-organism is responsible for the disturbance and the preparation therefrom of an autovaccine. The use of such vaccine effects an arrest of the evolution of the pyorrhea and checks the primary causal infection.—Paris Letter, *J. A. M. A.*

FOREIGN LITERATURE

Mouth Hygiene (Fortschr. d. Zahnheilk., von Wilhelm Herrenknecht and Curt Scheidt, No. 8, 1929, p. 715): Mouth hygiene deals largely with the fight against caries and paradental disease. The problem of the prevention of caries is, for one thing, a problem of nutrition. Even the resistance to caries can, in the expectant mother and child, be increased with the proper addition of vitamins to the diet. Oral prophylaxis and the early repair of carious teeth should of course not be neglected. The Miller chemicoparasitic theory of caries is today questioned by Baumgartner, Fleischmann, Gottlieb and Bödecker. Yet it is still strongly affirmed by Türkheim. Clark, d'Alise, Levine, Türkheim, Simon and Schmitz believe that the increase of the hydrogen ion concentration from lactic acid fermentation is hardly sufficient to bring about a decalcification of the enamel. The author believes with Bödecker that the saliva as such is not the cause of decalcification, but rather it is the lack of irrigation of the protected areas by saliva that permits a decalcification. We know today at least that the hydrogen ion concentration of the saliva cannot be effectively influenced by the use of alkaline dentifrices. It is however desirable to promote the free flow of saliva in order to irrigate generously all surfaces of the teeth. This is contrary to the "acid prophylaxis" conception of Peckerill, also supported by Häupl and Bergve. The uselessness of antiseptics in the oral cavity should be apparent by now. It has again been emphasized by L. Veader and A. Feirer. Oser and Luscher have shown that the hydrogen ion concentration cannot be influenced even by the introduction of medicaments into the pockets, much less could it be accomplished by the use of medicaments in oral prophylaxis. Therefore, it should not be the aim of prophylaxis to alter the physiologic-chemic composition of the saliva, but rather

to deal with the tooth surfaces locally. It is likewise impossible to destroy bacteria. It should be the aim of local prophylaxis to remove food particles and deposits from tooth surfaces and thus prevent the formation of caries.

EMIL MUELLER, Chicago.

Light and Heat Therapy (von Georg Blessing and Gerard Weisenfels, Fortschr. d. Zahnheilk., No. 7, 1929, p. 608): Within the last few years, a number of scientific reports dealing with light and heat therapy have appeared in the field of medicine. The results achieved are of such clinical importance that a dentist may obtain much useful information from them. Light therapy has become a powerful weapon in the fight against rickets. Huldschinsky discovered the specific action of light rays in this condition. Hesz was able to treat rickets successfully by treating different substances, such as milk, with light rays outside the body. Windaus discovered that activated "ergosterin" was the specific antirachitic factor. This is now available under the trade name of "vigantal." Rickets is treated with direct rays, "vigantal," milk and other substances previously exposed to ultraviolet rays. Direct exposure to rays has many advantages, but this is usually difficult because patients have to be brought to the office. There is also the danger of infection. Consequently, the other two methods find most frequent usage. Prophylaxis is more desirable than treatment. The dentist is particularly interested in prophylaxis since rickets involves various types of calcification disturbances which frequently affect the teeth. Prophylaxis should begin not with the child, but with the expectant mother. "Vigantal" should be administered in order to supply vitamin D to the developing fetus. For a detailed description of violet ray appliances, the author refers to the 1927-1928 issues of the same journal. In the present article, the newer modifications are described. Experience with diathermy has shown that the bone accumulates heat faster than the soft tissues; and therein lies the danger of burning, which becomes greater the smaller the field of application. In order to reduce the danger of burning, the larger electrode is placed on the neck, the other against the jaw in the vestibulum oris. A new appliance "thermidion" has recently been introduced by Kristiansen for the purpose of coagulating and devitalizing pulp remnants, chiefly at the apex. He also advocates it for the treatment of apical infections and stoppage of hemorrhage.

EMIL MUELLER, Chicago.

Fillings (Rudolf Weber, Fortschr. d. Zahnheilk., No. 6, 1929, p. 429): The phase of dentistry which deals with fillings and filling materials is governed much more by fixed rules than are all the other phases of dental procedures. In reviewing the literature of recent years, one is strongly impressed by the fact that most of it deals with the materials used rather than with tooth anatomy, since that phase of the filling technic is governed by fixed rules. In Europe, little is written today on preparation of carious cavities. The American periodicals attest to the fact that Black's teachings are still accepted in that country almost without exception, and justly so, since Black formulated the principles for cavity preparation. These have been modified somewhat, particularly by Volland and Tinker. In contrast to the European dental literature, much has been written pertaining to materials and methods of inlay construction, and it is on this phase that Europe has much to learn from America. From Tinker, cavity preparation and methods of taking inlay impressions are learned. Grunn describes their methods for the heating of waxes. He employs the so-called high heat technic. Dr. Volland is one of the successful exponents of the low heat technic. A rather complete summary which deals with the whole phase of the casting process is offered by Maves in his eighteen rules. The Hollenbeck system and apparatus for inlay construction is also of great interest. The inductions and contra-inductions of porcelain and gold inlays are ably treated by Le Gro. Exact references are found under the literature. These are with one exception all American.

EMIL MUELLER, Chicago.

MISCELLANY

BOOK REVIEW

Index of the Periodical Dental Literature. Published in England, Canada, Australia, New Zealand and the United States. For three years, 1924-1926. A classified subject index on the plan of the Dewey Decimal Classification. An alphabetical author index. A list of dental books reviewed during the same period. Compiled by Arthur D. Black, A.M., M.D., D.D.S., Sc.D., Dean, Northwestern University Dental School. Published by the Dental Index Bureau, 381 Linwood Ave., Buffalo, N. Y. Henry Kimpton, 263 High Holborn, London, Eng. Under the auspices of the American Association of Dental Colleges, American Dental Association, Research Commission of the American Dental Association, British Dental Association, Canadian Dental Association, New Zealand Dental Association, and Society of Dental Science of New South Wales; 1929. Administrative Board of the Dental Index Bureau: H. E. Friesell, Chairman, Pittsburgh, Pa., Arthur D. Black, Editor, Chicago, Ill. Abram Hoffman, Secretary-Treasurer, Buffalo, N. Y., and William Bebb, Librarian, Chicago, Ill. Price, $6.00.

This is the eighth of the series to be published, and by this time the work is so well known that it is unnecessary to amplify its value. As the years go by, these volumes will be of increasing worth, and it is doubtful that the rank and file of the profession realize today the significance of the work that is being done through this agency. The growing volume of dental literature is well illustrated by the fact that most of the volumes in the past have taken in a five-year period, while the present one of similar or larger size covers only a three-year period.

We bespeak for this work a most cordial reception from the profession.

NEWS

Mr. Eastman Gives Clinic to Rome: Mr. George Eastman, of Rochester, N. Y., donor of the Rochester Dental Dispensary and of the Eastman Dental Clinic of London, recently signed a contract with two representatives of the Italian government whereby Mr. Eastman is to contribute $1,000,000 for a dental dispensary in Rome, for which the Italian government is to furnish the site, maintenance and equipment. The chief work of the clinic is to be the care of the teeth of indigent Italian children under 16 years of age, and any emergency work that is done for adults is not to interfere with the work for children.

California University Course for Hygienists: The University of California College of Dentistry announces their curriculum for the training of dental hygienists for the year 1929-1930, the eleventh session. The course is open to women only.

Federal Court Rules On Drug Labels: A far-reaching decision on the labeling of medicinal preparations has been handed down by the U. S. Court of Appeals for the Ninth Circuit, say the officials of the Food, Drug and Insecticide Administration, of the United States Department of Agriculture. According to the decision of the Court of Appeals, the use on labels of medicinal preparations of language which, when read literally, is not a statement of curative or therapeutic properties, but, owing to attendant circumstances, may be understood as such, brings these labels within the scope of the Federal food and drugs act just as definitely as if direct statements appeared. This decision was made upon appeal by the United States Government from a judgment entered in the District Court for the Western District of Washington, dismissing a case brought against certain medicinal preparations which, the Government alleged, bore false and fraudulent therapeutic claims on the labels. The Federal food and drugs act, under which this action was brought, is designed, among other things, to prevent the sale in interstate commerce of medicinal preparations bearing false and fraudulent statements concerning their efficacy in treating disease. The lower court dismissed the libel on the ground that it failed to allege facts sufficient to show a violation of the law, in that the statements on the labels to which the Government took

exception were not therapeutic or curative claims but were merely reports indicating that physicians had obtained favorable results from the use of the nostrum, each "report" being preceded by the statement, "We have received many letters from physicians reporting." The Circuit Court of Appeals, however, held that language such as that used would tend to engender a belief on the part of possible buyers that the use of the drugs would afford relief. "Unless we discredit their mental competency, such, we must presume, was the intent and expectation of the proprietors," said the Circuit Court. "Their contention is that they have such letters or reports and that that fact constitutes a competent defense, whatever may be the character of the drugs. But if, as is alleged, the drugs are worthless the proprietors cannot escape responsibility by hiding behind the phrase 'the doctors say.' Couched in such language undoubtedly the printed matter makes a more persuasive appeal to the credulity of sufferers from these diseases than if the representations thus implied were made directly upon the authority alone of the proprietors, and for that reason they are not less but more obnoxious to the law." Furthermore the court held that the following principle of construction set forth in an opinion of the Supreme Court rendered in a case against vinegar brought under the food and drugs act is conclusive in this case also: "The statute is plain and direct. Its comprehensive terms condemn every statement, design and device which may mislead or deceive. Deception may result from the use of statements not technically false or which may be literally true. The aim of the statute is to prevent that resulting from indirection and ambiguity, as well as from statements which are false. It is not difficult to choose statements, designs and devices which will not deceive. Those which are ambiguous and liable to mislead should be read favorably to the accomplishment of the purpose of the act."

Governmental Action Improves Antiseptics: Much more dependence may now be placed on antiseptics for human and animal use than was the case two years ago, or even a few months ago, say officials of the Food, Drug and Insecticide Administration, United States Department of Agriculture, who are now completing an extensive investigational survey of these preparations sold in interstate drug trade. More than one thousand products described by their makers as antiseptics have been investigated with bacteriological tests made for most of them. Mouth washes, douche powders, suppositories, salves, liniments, dusting powders, toothpastes, and soaps were included among these preparations. Few manufacturers had ever tested their antiseptics bacteriologically, the survey revealed. Some were under the impression that a chemical such as carbolic acid, for example, would be antiseptic no matter how weak a solution was used. Hundreds of so-called antiseptic preparations were found misbranded and bearing false claims. The most an antiseptic can be depended upon to do is to destroy or inhibit the growth of bacteria on or very close to body surfaces. Many of these misbranded preparations were found to be offered as competent treatments for abscesses, la grippe, piles, sores of every description, sore throat, all forms of skin diseases, and diseases of the female reproductive tract. Some were even recommended to be taken internally for indigestion, stomach ulcers, cholera morbus, dysentery, and similar troubles. Most of the mouth washes and douche powders were found to be modifications of the products described in the National Formulary as "Antiseptic Solution" and "Antiseptic Powder." The first of these is antiseptic only when used full strength; the second only when used as a dry dressing but not when dissolved in water for use in douching. When manufacturers were advised to label their products truthfully to avoid violating the Federal food and drugs act, the majority willingly and promptly did so. They either revised their labels and directions or else changed their formulas to justify the claims made for the products. Makers of 45 so-called antiseptics removed their preparations from the market rather than to make any change or to face legal action. In only 20 cases was it necessary for the administration to resort to legal action to secure compliance with the act. The drive against worthless and misbranded antiseptics for human and animal use resulted from representations made late in 1926 to the Department of Agriculture that many antiseptics were being sold in open violation of the Federal food and drugs act, which requires that all drug products sold in interstate trade be correctly and truthfully labeled. In a preliminary survey of several well-known antiseptics, it was found that

most of these preparations were either non-antiseptic or recommended in dilutions too weak to have any effect on bacteria. In fact, two of the so-called antiseptics examined at that time actually contained living bacteria. The need of making a nation-wide survey of all antiseptic preparations became evident to protect the public from fraud as well as from the consequences of placing confidence in useless medicinal products. The first public announcement of the drive was made at the April 7, 1927 meeting of the American Drug Manufacturers association by two Department of Agriculture officials. Definitions of the word "antiseptic" as found in correct dictionaries were discussed. It was pointed out at that time, and it has been the unchanging stand of the administration ever since, that the important factor in deciding whether an antiseptic should kill bacteria or simply prevent their growth depended upon the length of time the product would be in contact with the body. Such products as mouth washes, douches and gargles, as used are in contact with the body for but a few seconds, and therefore can only be considered antiseptic if they kill bacteria in the dilutions recommended and in the length of time they are in contact with the body. Salves, ointments, dressings and other products in contact with the body for prolonged periods of time may properly be called antiseptic if they merely prevent the growth of bacteria. All antiseptic preparations sold interstate must be labeled truthfully and in full compliance with the Federal food and drugs act, say officials of the Food, Drug and Insecticide Administration. The investigation of these products will be continued in the nature of a resurvey.

National Research Council, Science Advisory Committee to the Century of Progress: The achievements made in the medical and allied professions during the past one hundred years through the aid of pure and applied science may be graphically shown at the Chicago World's Fair Centennial Celebration to be held in 1933. Leading authorities in these professions have been invited to serve on the National Research Council Science Advisory Committee to the Fair. They have been asked to advise ways and means as how to interpret in a concrete tangible form the advances made in their respective fields since applied science entered their fields up to the present day. The medical men serving on the general committee include such well-known men as: Prof. R. R. Bensley of the department of anatomy, of the University of Chicago, on anatomy; Dean Arthur D. Black of the dental school of Northwestern University, dentistry; Dr. Frank Billings of Chicago, medicine; Prof. Preston M. Hickey of the Medical School of the University of Michigan on roentgenology; Prof. Stanhope Bayne-Jones of the School of Medicine and Dentistry of Rochester University, bacteriology; Prof. Fay-Cooper Cole of the department of anthropology of the University of Chicago, anthropology; and Prof. Harvey A. Carr of the department of psychology of the University of Chicago, psychology. The National Research Council Science Advisory Committee was formed at the request of the trustees of the Chicago Exposition. As the most far reaching scientific body in the United States, the trustees asked the National Research Council to prepare a philosophy for a world's fair which would be of an entirely different character than any exposition ever held before. This philosophy is to deal with the progress made by pure and applied science in industry since the beginning of the so-called Industrial Revolution up the present time. It is planned to make science one of the dominant notes of the Exposition. Leading engineers and scientists from all sections of the United States are members of this general advisory committee and they will strive to formulate a philosophy for the Exposition that may be suggested as a basic plan for the Fair. The members of the general committee will submit to the executive committee ideas which it is hoped to coordinate into a central working plan by early fall. As now planned the Chicago World's Fair Centennial Celebration, which will be known as "The Century of Progress" will probably offer the most unusual opportunity in the history of science for a physical demonstration of the progress of pure and applied science in the development of industry. The Science Advisory Committee is headed by an executive committee the members of which are: Dr. Frank B. Jewett, New York, chairman; Dr. George K. Burgess, Washington, D. C.; Dr. Vernon Kellogg, Washington, D. C.; Gano Dunn, New York; Prof. M. I. Pupin, New York; and Dr. William Allen Pusey, of Chicago. Maurice Holland of New York, has been appointed executive secretary of the committee which

has established offices at 40 West 40th Street, New York City.

DEATHS

Buck, Claude Enoch, Downey, Calif.; University of Southern California College of Dentistry, 1907; died, July 19, from heart disease; aged 48.

Farnsworth, W. R., Cissna Park, Ill.; Baltimore College of Dental Surgery, 1905; died, August 10, of cirrhosis of the liver; aged 47.

Treat, C. V., Beverly and Vermont, Calif.; University of Southern California College of Dentistry, 1924; died, August 9.

ANNOUNCEMENTS*

CALENDER OF MEETINGS

NATIONAL SOCIETIES

American Dental Association, Washington, D. C., Oct. 7-11, 1929.

American Academy of Periodontology, Washington, D. C., Oct. 3-5, 1929.

American Dental Asisstants Association, Washington, D. C., Oct. 7-10, 1929.

American College of Dentists, Washington, D. C., Oct. 6, 1929.

American Dental Hygienists Association, Washington, D. C., Oct. 7-11, 1929.

American Full Denture Society, Washington, D. C., Oct. 1, 1929.

American Society for the Promotion of Children's Dentistry, Washington, D. C., Oct. 10, 1929.

Association of American Women Dentists, Washington, D. C., Oct. 7, 1929.

National Association of Dental Examiners, Washington, D. C., Oct. 5, 1929. George L. Powers, Secretary, Memphis, Tenn.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

January (1930)

Pennsylvania, at Harrisburg (30-31).

April (1930)

Connecticut, at Stamford (22-24).

May (1930)

New York, at New York City (12-16).
North Carolina, at Asheville (5-8).

First District Dental Society of New York, Dec. 10-14, 1929.

Southwestern Dental Society, El Paso, Texas, October, 1929.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Connecticut, at Hartford, November 18-21. A. J. Cutting, Recorder, Southington.

Indiana, at Indianapolis, November 11. J. M. Hale, Secretary-Treasurer, Mt. Vernon.

Minnesota, at Minneapolis, December 13. F. E. Cobb, Secretary, 601 Donaldson Bldg., Minneapolis.

New Jersey, at Trenton, December 2-7. John C. Forsyth, Secretary, 148 W. State St., Trenton.

Virginia, at Richmond, November 4. John M. Hughes, Secretary, 715 Medical Arts Bldg., Richmond.

AMERICAN COLLEGE OF DENTISTS

The annual convocation of the American College of Dentists will be held in the Mayflower Hotel, Washington, D. C., Sunday evening, October 6, at 6:30.

ALBERT L. MIDGLEY, *Secretary,*
Providence, R. I.

DENTAL SOCIETY OF THE STATE OF NEW YORK

The sixty-second annual meeting of the Dental Society of the State of New York will be held the week of May 12-16, 1930, at the Hotel Commodore, New York City. A cordial invitation is extended to all ethical dentists resident in the United States and Canada. In addition to the usual excellent scientific program and general clinics, there will be a series of educational clinics given

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

the first two days. Full details and information regarding enrollment will be published at a later date. The usual preliminary program will be issued in January and the official program in April. Exhibitors desiring space, address T. C. Swift, 1 Park Ave., Mt. Vernon. Please apply early for information and space. For further information, address the secretary.

WILLIAM C. FISHER, *President,*
A. P. BURKHART, *Secretary,*
57 E. Genesee St.,
Auburn.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The fall meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning promptly at 9 a. m., November 4. Applicants are required to present a certificate from the state board of education showing that they have had one year of academic education equal to one year of college work. Applications, with fee and photograph, must be filed complete, ten days before the examination. For application blanks and further information, apply to

JOHN M. HUGHES, *Secretary,*
715 Medical Arts Bldg.,
Richmond.

STATE OF MINNESOTA BOARD OF DENTAL EXAMINERS

The next meeting of the Minnesota State Board of Dental Examiners will be held December 13 at the University of Minnesota, College of Dentistry, Minneapolis. Application blanks may be obtained from the secretary and must be in his office not later than December 1.

F. E. COBB, *Secretary,*
601 Donaldson Bldg.,
Minneapolis.

ALPHA OMEGA FRATERNITY

The twenty-second annual convention of the Alpha Omega Fraternity will be held in Philadelphia, December 23-25, at the Benjamin Franklin Hotel.

WILLIAM ERSNER, *Chairman,*
Convention Publicity,
1915 Spruce St.,
Philadelphia.

INDIANA BOARD OF DENTAL EXAMINERS

The Indiana Board of Dental Examiners will meet at 8 a. m., November 11, at the State House, Indianapolis, in the room of the House of Representatives, for the purpose of examining all applicants with proper credentials. Applications should be in the hands of the secretary one week before the board meeting. For applications, clinical requirements and other information, address

J. M. HALE, *Sec'y-Treas.,*
Mt. Vernon.

GREATER NEW YORK DECEMBER MEETING FOR BETTER DENTISTRY

The First and Second District Dental Societies will continue the series of meetings which were formerly conducted by the First District Dental Society and widely known as the "December Meeting for Better Dentistry." The session this year, which is the fifth annual meeting, will therefore be conducted jointly by the two societies at the Hotel Pennsylvania, **December 9-13.**

Among the essayists and clinicians who have accepted invitations to be present are: Wallace Seccombe, Toronto; J. R. Blayney and John B. La Due, Chicago; Chalmers J. Lyons, Ann Arbor; Charles A. Lane, P. Kyprie and Albert L. LeGro, Detroit; Dayton D. Campbell, Kansas City; James M. Prime, Omaha; Hugh W. MacMillan and Carlos H. Schott, Cincinnati, and Theodore W. Maves, Cleveland.

The meeting will be continued on the same plan as previous meetings, $5.00 admitting members to all lectures, clinics, etc. A subscription blank and list of clinics will be ready for circularization November 1.

There will be a manufacturers' exhibit in the hotel during the meeting.

JOHN T. HANKS, *Chairman.*

HUDSON COUNTY DENTAL SOCIETY

The Hudson County Dental Society will entertain, at its meeting October 5, George B. Winter, professor of exodontia, Washington University School of Dentistry, St. Louis. Dr. Winter, the author of "Exodontia of the Mandibular Third Molar," will be the essayist of the evening. His talk will be profusely

illustrated by lantern slides of practical cases and will be of value to every general practitioner. Preceding Dr. Winter's lecture, there will be a formal dinner in his honor in the Grand Ballroom of the Hotel Plaza, Journal Square, Jersey City, N. J. Reservations for this dinner, at $5 per plate, may be made by communicating with Frank J. Houghton, chairman of the dinner committee, Trust Company of New Jersey Building, Jersey City, N. J. All the members of the American Dental Association are cordially invited to this meeting.

The Hudson County Dental Society,
MAX M. SCHWARTZ, *Reporter.*

BALTIMORE SCHOOL TO BE DEDICATED

The National Alumni Association of the Baltimore College of Dental Surgery, Dental School, University of Maryland, has sent out invitations to the celebration which will be held in Baltimore, October 4-6. Friday, October 4 will be known as Class Reunion Day, and a chairman has been appointed to sponsor the entertainment of each graduating class of the Baltimore College of Dental Surgery, Dental Department of the Baltimore Medical College, and the University of Maryland, School of Dentistry.

Saturday, October 5, at noon, a tablet marking the site of the original school building of the old Baltimore College of Dental Surgery will be unveiled, and, at the unveiling exercises, Percy R. Howe, director of the Forsyth Dental Infirmary, will be the principal speaker. The Hon. William F. Broening, mayor of Baltimore, will also address the gathering. At this ceremony, George E. Hardy will preside. These exercises will be followed by a luncheon at the Lord Baltimore Hotel.

The new home of the Baltimore College of Dental Surgery, Dental School, University of Maryland, which is located at Lombard and Greene Streets, will be dedicated at 3 o'clock on the same day. The director of ceremonies will be B. Lucien Brun, and addresses will be made by the Hon. Albert C. Ritchie, governor of Maryland; Raymond A. Pearson, president of the University; Harvey J. Burkhart, director of the Rochester Dental Dispensary, and J. Ben Robinson, dean of the School. The building will be open for inspection after the dedication. The reunion banquet will be held at the Lord Baltimore Hotel on the evening of October 5, at which Frank P. Duffy, president of the National Alumni Association of the school, will be toastmaster and Richard L. Simpson, of Richmond, and Paul R. Stillman, of New York, will speak.

Entertainment is being arranged for the visiting alumni and their families who will remain in Baltimore for Sunday, October 6.

Graduates desiring information pertaining to the affair should address Horace M. Davis, General Chairman, Medical Arts Building, Baltimore.

EXAMINATION FOR APPOINTMENT TO DENTAL CORPS OF U. S. NAVY

A competitive examination for appointment to the Dental Corps of the United States Navy will begin December 2, at the U. S. Naval Medical School, Washington, D. C. Candidates must be citizens of the United States, between 21 and 32 years of age at the time of appointment, and graduates of recognized dental schools. The examination will be both theoretical and clinical and the usual duration is about seven days. A circular containing full information relative to the Dental Corps and the prescribed form of application may be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. No allowance is made for the expense of applicants appearing for examination.

C. E. RIGGS, *Surgeon-General,*
U. S. Navy.

NAVY DAY, OCTOBER 28

The annual observance of Navy Day, now in its eighth year, will be held Monday, October 28. The object of the occasion is to foster a proper understanding of the purposes and state of our Navy. It is being sponsored by the Navy League of the United States, and has the endorsement of the Secretary of the Navy. Every citizen of the United States should take an interest in this movement, for the reason that, on account of its geographic location, this country is naturally a maritime nation. This fact seems sometimes to be forgotten by those living far inland; but it should be remembered that the condition of our Navy is a matter of vital importance to every citizen of our commonwealth.

A VACATION TRIP AFTER THE WASHINGTON MEETING

Following the plan inaugurated by the late D. C. Bacon of combining attendance at the annual meeting of the American Dental Association with a vacation trip to some of the famous beauty spots of this continent, a visit to the adjacent island of Bermuda has been arranged by L. L. Davis in cooperation with Powers Tours after the close of the sessions in Washington.

A very attractive trip has been planned. We leave Washington Friday afternoon, October 11, sailing from New York, Saturday morning, October 12. A bloc of desirable reservations has been set aside on the palatial steamer, "The Bermuda," and special arrangements have been made to entertain the party enroute; a stop of six days will be made on these beautiful islands, known as "the garden spot of the Atlantic," during which time a full program has been arranged; boating, fishing, golf, sight-seeing and picnic parties; gorgeous days of sunlight and nights of dancing and gaiety.

Already quite a large number of dentists from various parts of the United States, their families and guests have booked their reservations. "On to Bermuda" seems to be the after-convention slogan. To secure accommodation with this specially conducted party, immediate communication should be made with those in charge.

The all-expense rate from Chicago, including every item of expense except meals while in Washington, is $285; rates from Washington, $197.25; and $171.25 from New York. For reservations and descriptive pamphlet apply Powers Travel Bureau, 111 W. Washington Street, Chicago. During the period of convention a special representative of the company will be at the Williard Hotel, Washington, to book those wishing to join the party from that point and who have been unable to get in touch with the company previously.

RAILROAD RATES TO WASHINGTON, D. C.
CHANGE IN PLAN.

The American Dental Association is discontinuing the use of the Identification Convention Certificate, and this year is using the "Certificate Plan." The certificates will be obtainable from your railroad agent, and NOT THROUGH THIS OFFICE. Full information will be sent to each member of the Association, giving dates of sale of tickets in all sections of the United States.

The following directions are submitted for your guidance:

1. Be sure that when purchasing going ticket you request a CERTIFICATE. *Do not make the mistake of asking for a "receipt."*

2. Present yourself at the railroad station for tickets and certificates at least thirty minutes before departure of train on which you will begin your journey.

3. *Certificates are not kept at all stations.* If you inquire at your home station, you can ascertain whether certificates and through tickets can be obtained to the place of meeting. If they are not obtainable at your home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local ticket to the station which has certificates in stock, where you can purchase a through ticket and at the same time ask for and obtain a certificate to the place of meeting.

4. *Immediately on your arrival at the meeting present your certificate* to the endorsing officer, Harry W. Nelson, Vice-President, as the reduced fares for the return journey will not apply unless you are properly identified as provided for by the certificates.

5. It has been arranged that the special agent of the carriers will be in attendance, October 7-11, from 8:30 a. m. to 5:30 p. m., to validate certificates. If you arrive at the meeting and leave for home again prior to the special agent's arrival, or if you arrive at the meeting later than October 11, after the special agent has left, you cannot have your certificate validated and consequently you will not obtain the benefit of the reduction on the home journey.

6. Certificates issued to children at half fares will be counted the same as certificates held by adults.

7. If your certificate is duly validated, you will be entitled, up to and including October 15, to a return ticket via the same route over which you made the journey *at one-half of the regular one-way tariff fare* from the place of meeting to the point at which your certificate was issued.

8. Return tickets issued at the reduced fares will not be good on any limited train on which such reduced fare transportation is not honored.

9. *No refund of fare will be made on account of failure to obtain a proper certificate when purchasing going tickets, nor on account of failure to present a validated certificate when purchasing return ticket.*

TRUNK LINE ASSOCIATION

Sale dates for New York State (east of and including Buffalo, Niagara Falls, Suspension Bridge and Salamanca), New Jersey, Pennsylvania (east of and including Erie, Oil City and Pittsburgh), Delaware, Maryland, District of Columbia, Virginia and West Virginia (east of and including Wheeling, Parkersburg, Kenova, Orange and Norfolk).....Oct. 3-9*

Final honoring date.....Oct. 15

TRANSCONTINENTAL PASSENGER ASSOCIATION

WESTERN PASSENGER ASSOCIATION

Sale dates for Colorado (Julesburg only), Illinois, Iowa, Kansas, Manitoba†, Minnesota, Missouri, Nebraska, Nor. Michigan, North Dakota, South

*Dates quoted are inclusive.

†Manitoba (on Great Nor., Nor. Pac. and M., St. P. & S. S. M. Rys., also from Winnipeg via Can. Nat'l and Can. Pac. Rys.).

Dakota, Wisconsin ..... Oct. 3-9
Colorado (except Julesburg), New Mexico, Wyoming ..... Oct. 2-8
Arizona, British Columbia, Idaho, Montana, Nevada, Utah, Oregon (except via California), Washington ..... Oct. 1-7
California ..... Sept. 30-Oct. 6
Oregon (via California) ..... Sept. 29-Oct. 5
Final honoring date ..... Oct. 15

SOUTHEASTERN PASSENGER ASSOCIATION

Sale dates for points in territory (south of the Ohio and Potomac and east of the Mississippi Rivers) ..... Oct. 3-9
Final honoring date ..... Oct. 15

NEW ENGLAND PASSENGER ASSOCIATION

Sales dates for points in territory (New England) ..... Oct. 3-9
Final honoring date ..... Oct. 15

SOUTHWESTERN PASSENGER ASSOCIATION

Sale dates for Oklahoma, Texas ..... Oct. 2-8
Arkansas, Kansas, Louisiana, Missouri, Memphis, Tennessee, and Natchez, Miss. ..... Oct. 3-9
Final honoring date ..... Oct. 15

CANADIAN PASSENGER ASSOCIATION—WESTERN LINES

Sale dates for British Columbia ..... Oct. 1-7
Alberta ..... Oct. 2-8
Saskatchewan, Manitoba, Ontario (west of Port Arthur and Armstrong) ..... Oct. 3-9
Final honoring date ..... Oct. 15

CANADIAN PASSENGER ASSOCIATION—EASTERN LINES

Sale dates for points in territory (Canada—east of and including Armstrong and Fort William and Sault Ste. Marie, Ont.) ..... Oct. 3-9
Final honoring date ..... Oct. 15

CENTRAL PASSENGER ASSOCIATION

Sale dates for points in territory (west of Buffalo, Niagara Falls, Salamanca, Pittsburgh, Wheeling, Parkersburg, and Kenova to and including Chicago and St. Louis, and north of the Ohio River, including Cincinnati, Louisville and Cairo) ..... Oct. 3-9
Final honoring date ..... Oct. 15

HOTELS	Rooms	Single with Bath	Double with Bath	Single without Bath	Double without Bath
BLACKSTONE 17th St., Btw. K. & L.	100	$3.00-5.00	$5.00-6.00		
BURLINGTON Vermont Ave. Thomas Circle	200	3.00-4.00	5.00-7.00	$2.50	$4.00
CAPITOL PARK N. Capitol & E.	150	3.00-4.00	4.00-6.00	2.00 up	3.00 up
CARLTON 16th & K. St.	260	5.00-7.00	8.00-12.00		
COMMODORE N. Capitol & F.	154	2.50-3.50	4.50-6.00		
CONTINENTAL N. Capitol & E.	250	3.00-4.00	5.00-7.00	2.00-2.50	3.00-4.00
DRISCOLL 1st & B. Sts.	200	3.50	6.00	2.00 up	3.00 up
EBBITT 1000 H. St.	150	2.50-3.00	4.00-5.00		
GRACE DODGE N. Capitol & E.	300	3.00-4.00	5.00-8.00	2.50-3.00	4.00-5.00
GRAFTON Conn. Ave., Btw. L. & N.	125	3.50-6.00	5.00-8.00	2.50-3.50	4.00-5.00
HARRINGTON 11th & E.	300	2.50-5.00	5.00-8.00	2.50 up	3.50-5.00
LAFAYETTE 16th & Eye Sts.	200	4.00-6.00	6.00-8.00		
MAYFLOWER Connecticut Ave.	650	5.00-10.00	7.00-15.00		
METROPOLITAN 6th & Pa. Ave.	175	2.50	4.00 up	1.50 up	3.00 up
POWHATAN Pa. Ave. & 18th	300	3.00-5.00	6.00-9.00		
RALEIGH 12th & Pa. Ave.	460	4.00-6.00	5.00-10.00	3.00-4.00	4.00-6.00
WARDMAN PARK Conn. Ave. & Woodley	400	uniform rate $5.00	uniform rate $8.00		
WASHINGTON Pa. Ave. & 15th	400	5.00-8.00	8.00-12.00		
WILLARD Pa. Ave. & 14th	475	5.00-10.00	7.00-15.00		
WINSTON 1st & Pa. Ave.	100	2.50 up	4.00 up	1.50 up	3.00 up

AMERICAN DENTAL ASSOCIATION

Washington, D. C. October 7-11, 1929.

HOTEL RESERVATIONS

In securing hotel reservations for the 1929 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which they make for you.

In case your first choice cannot be made, indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the Chairman of the Halls and Hotels Committee and he will place your reservation in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely to occupy the room at time agreed on, please write or wire the hotel releasing it, in order that your room may be available for other members.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, WASHINGTON, D. C., OCT. 7-11, 1929

.....Hotel. .....1929.
Washington, D. C.

Please reserve sleeping room accommodations as noted below:

.....room(s) with bath for.....people. Rate desired per day $.....

.....room(s) without bath for.....people. Rate desired per day $.....

Second choice hotel.....

Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

Important to Hotel Manager: In the event you cannot accept this reservation, please forward this application at once to Dr. R. L. Morrison, Chairman Halls and Hotels Committee, Suite 706, 1103 Vermont Ave., N. W., Washington, D. C., who will attend to the assignment of this reservation.

SOME 1929 BOOKS*

Available for Circulation from the

LIBRARY BUREAU

of

AMERICAN DENTAL ASSOCIATION

58 East Washington Street

Chicago

American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929.
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929.
Bunting, R. W.	Text-book of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929.
Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929.
Diamond, M.	Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929.
Gregory, W. K.	Our face from fish to man. New York, Putnam, 1929.
Hyatt, T. P.	Hygiene of the mouth and teeth. Brooklyn, N. Y., Brooklyn Dental Pub. Co., 1929.
Kent, E. N.	Business side of dentistry. St. Louis, Mosby, 1929.
Orban, Balint	Dental histology and embryology. Philadelphia, Blakiston, 1929.
Osgood, H. A.	Teeth and jaws roentgenologically considered. Annals of roentgenology, volume 5. New York, Hoeber, 1929.
Schroff, Joseph	Fundamentals of pathology. New York, W. A. Broder, 1929.
Sears, H. H.	Full denture procedure. New York, Macmillan, 1929.
Stillson, W. C.	Dental anatomy: classroom and laboratory quiz compend with supplementary notes. Philadelphia, Saunders, 1929.
Stoloff, C. I.	Your teeth. New York, Dutton, 1929.

*Books may be borrowed by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume asked for should accompany all requests for books. This will be refunded on return of books.

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1929

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